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ABSTRACT

The participation in certain classroom processes by students of high and low mathematics confidence who scored above the mean in mathematics achievement was studied over 2 years. The processes selected were: (1) specified types of teacher-pupil interactions, and (2) student engaged time in high or low cognitive level mathematical activities, spatial activities, and with peers. Eighty-two seventh graders were observed daily in their regular mathematics classes for 3 to 4 weeks during the spring semester of 1980, and were again observed in 1981. Between 3 and 14 target students were within each observed class. Roughly equal numbers of each sex were chosen based on the following characteristics for the sample: (1) mathematics achievement scores were at or above the sixth-grade mean of four middle schools, and (2) confidence in mathematics scores were in either the top or bottom quarter for all pupils who had achieved higher than the mean. Two trained observers recorded data on target student and teacher behavior in each classroom. Data were collapsed across classrooms and analyzed using analysis of variance, with sex, confidence level, and year as factors. (MP)

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Teacher/Peer Influences on Sex Differences in Mathematics Confidence

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TABLE OF CONTENTS

Page

LIST OF TABLES iv

LIST OF FIGURES v

ABSTRACT vi

Introduction 1

Review of Literature 1

Sex-Related Differences in Mathematics 2

The Study 4

Sample 4

Observation Instruments 6

Teacher-Student Interaction 6

Engaged Time 8

Data Collection 10

Observer Training 10

Data Collection 13

Observer Agreement 13

Teacher-Student Interaction 13

Engaged Time 14

Data Analyses and Results 16

Teacher-Student Interactions 16

Teacher Behavior 25

Student Behaviors 45

Engaged Time 45

Conclusions and Discussion 50

Page

References 53

Appendices

Appendix A--Observer's Manual 55

Appendix B--Data Sheets 121

Appendix C--Observer Agreement 125

Appendix D--Teacher-Pupil Interactions: Two Year Plots 144

Appendix E--Teacher Feedback - Two Year Plots 162

LIST OF TABLES

TABLE Page

1 Means, Standard Deviations, and n's for Mathematics Achievement and Confidence by Sample Group 5

2 ANOVA for Confidence in Mathematics by Sex and Confidence Level for Sample Group 6

3 ANOVA for Mathematics Achievement by Sex and Confidence Level for Sample Group 6

4 Number in Each School, Classroom, and Group 7

5 Teacher-Student Interaction Observation Categories . . . 9

6 Means and Standard Deviations of Frequencies per Day for Public Teacher-Student Interaction Categories by Sex, Confidence Level, and Year 17

7 Means and Standard Deviations of Frequencies per day for Private Teacher-Student Interaction Categories by Sex, Confidence Level, and Year 18

8 F-ratios and Probability Levels from ANOVAs by Sex, Confidence Level, and Year for Public Teacher-Student Interaction Categories 19

9 F-ratios and Probability Levels from ANOVAs by Sex, Confidence Level, and Year for Private Teacher-Student Interaction Categories 20

10 Means and Standard Deviations of Percent of Time Engaged by Sex, Confidence Level, and Year 43

11 F-ratios and Probability Levels from ANOVAs: Sex, Confidence Level, and Year for Engaged Time Categories . 44

LIST OF FIGURES

FIGURE Page

1 Interacations MF/D . . . 22
2 Public Interactions MF/D . . . 23
3 Private Interactions MF/D . . . 24
4 Days with No Interactions . . . 26
5 Days with No Public Interactions . . . 27
6 Days with No Private Interactions . . . 28
7 Public Initiated by Teacher MF/D . . . 29
8 Private Initiated by Teacher MF/D . . . 30
9 Level of Question - Nonacademic MF/D . . . 31
10 Level of Question - Low MF/D . . . 32
11 Level of Question - High MF/D . . . 33
12 Response Opportunity - Direct MF/D . . . 35
13 Teacher Initiated Behavioral - Criticism MF/D . . . 36
14 Response Opportunity - Open MF/D . . . 37
15 Response Opportunity - Call Out MF/D . . . 38
16 Public Initiated by Student MF/D . . . 39
17 Private Initiated by Student MF/D . . . 40
18 Student Initiated Work - Low Level MF/D . . . 41
19 Student Initiated Work - High Level MF/D . . . 42
20 MN % Time Engaged . . . 46
21 MN % Eng High Level . . . 47
22 MN % Eng Spatial . . . 48
23 MN % Eng Peer . . . 49

Abstract

Studied was the participation in certain classroom processes over a two year period by girls and boys of high and low confidence in mathematics who scored above the mean in mathematics achievement. The classroom processes selected were (1) specified types of teacher-pupil interactions, and (2) student engaged time in high or low cognitive level mathematical activities, spatial activities, and with peers. Approximately equal numbers of seventh grade girls and boys who had the following characteristics were selected for the sample: (1) Mathematics achievement scores were at or above the mean of all sixth graders in four middle schools, and (2) Confidence in mathematics scores were in the top quarter or bottom quarter of the distribution for all the students who had achieved higher than the mean in mathematics. Eighty-two students (high confidence girls, low confidence girls, high confidence boys, and low confidence boys) were observed daily in their regular mathematics classes for 3-4 weeks during the spring semester of 1980 and again in 1981. Between three and fourteen students (i.e., target students) were observed in each mathematics class.

Two carefully trained observers recorded data on target student and teacher behavior in each classroom. One observer recorded characteristics of interactions between the teacher and individual target students. The second observer recorded engagement in mathematics and cognitive level of learning activities in which students were engaged. Data were collapsed across classrooms and analyzed using Analysis of Variance technique with sex, confidence level, and year as factors.

Introduction

That women are under-represented in occupations related to mathematics is an assertion that needs no support. Hypotheses as to why this occurs range from genetic differences between the sexes which limit females' ability to learn mathematics, to overt discrimination which limits females' employment opportunities. Neither type of hypothesis is particularly helpful in understanding why women are under-represented in mathematics-related occupations or in increasing the representation. Even if the genetic hypothesis has validity (which many doubt, [Nelson, 1977; Sherman, 1977]), the number of women now in careers related to mathematics is less than that which could be explained by any genetic differences. The overt discrimination hypothesis does not consider that adult females have less knowledge and fewer skills in mathematics than do adult males (as clearly indicated by the National Assessment of Educational Progress results [Mullis, 1975]). Until adult females' mathematical knowledge and skills are equivalent to those of adult males, unequal representation of the sexes in occupations related to mathematics will continue. Therefore, the major problem facing those concerned with equity in this area is ensuring that females acquire mathematical skills and knowledge equivalent to those acquired by males. In order to do this, knowledge about why females have not learned mathematics to the degree that males have is essential.

Although simplistic to state, this is not a simple problem. Involved in it is the cognitive acquisition of mathematics by females, as well as the attitudes or affective beliefs held by females, male peers, parents, and educators toward females as learners of mathematics. The cognitive and affective components are so intertwined that it is difficult, if not impossible, to separate them. Not only are they intertwined, but they are developed over a period of years in a complex social matrix which involves home, community, and school. One approach to follow in seeking to understand why inequity exists in the representation of the sexes in occupations related to mathematics is to focus attention on one important dimension in one part of this complex social matrix. Thus, the focus of this study was investigation of the development of sex-related differences in confidence in learning mathematics in the mathematics classroom and the influence of confidence on mathematics classroom participation.

The major questions addressed were:

1. Are there sex-related differences in participation in selected classroom processes?
2. Do girls and boys of different confidence levels participate differently in classroom processes?
3. Does the participation in classroom processes of girls and boys of different confidence levels change over time?

Review of Literature

Sex-Related Differences in Mathematics

In 1981, Fennema ended an overview of women and mathematics with the following conclusions:

1. There are still sex-related differences in electing to study mathematics in high school. While not as dramatic as were once suggested, females tend not to study, as much as do males, the most advanced mathematics courses and courses peripheral to math, such as computer science, statistics, and physics. It appears that the size of the differences varies tremendously by school and by region of country. At the post high school levels, differences are still large.

2. Even when amount of mathematics studied is controlled, females appear not to be learning math as well as are males in some instances. This trend should be of concern to all. When females excel, it is in lower level cognitive tasks. Even when females and males report they have been enrolled in the same mathematics courses, males perform better on more difficult and complex tasks.

3. There are psychological variables which may help in understanding sex-related differences. Females, as a group, more than males as a group, have less confidence in learning mathematics,* perceive mathematics to be less useful to them, and attribute successes and failures in mathematics differently.

4. Males perform better than females on tests of spatial visualization although the impact of spatial visualization on the learning of mathematics is largely unknown.

5. Classroom learning environments are different for females and males in a variety of ways.*

Of the few studies which have specifically investigated sex-related differences in one classroom process, i.e., engaged time, only one has indicated a difference between females and males, and this study (Yeger & Miezitis, 1980) found females engaged a higher percentage of the time than males. The literature does indicate differences in the number of interactions that occur between teachers and males and teachers and females, with males generally involved in more of some types of interactions than females.

What has the literature shown concerning high and low confidence students' participation in mathematics processes? Confidence in mathematics is an important variable in that it is correlated positively with student achievement and enrollment in mathematics courses, but is it one of the student characteristics which is related to classroom processes? Two studies were found which investigated classroom behaviors of high and low self-concept students (Shiffler et al., 1977; Yeger & Miezitis, 1980) but neither of these was concerned with mathematics classrooms. Both studies found low self-concept students off-task a greater percentage of the time than self-concept students. Yeger and Miezitis found differences in teacher-student interactions between high and low self-concept students with high self-concept students involved in more interactions with teachers and with peers than low self-concept students. Thus, answering yes to the second question--Do students with different levels of confidence in themselves as learners of mathematics participate differently in mathematics classroom processes?--receives some support.

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*For a complete review of literature on confidence in learning mathematics, and classroom learning environments, see Reyes, L.H. Classroom processes, sex of student, and confidence in learning mathematics. Unpublished doctoral dissertation, University of Wisconsin, 1981.

Little information is available about change in participation in classroom processes over time.

The Study

Sample

The sample consisted of 80 girls and boys who were in the 7th grade in Year I of the study and 8th grade in Year II. During the spring of 1979, all sixth grade students in four middle schools in a midwestern city were given the Mathematics Concept subtest of the Science Research Associates (Naslund, Thorpe, and LeFever, 1971) and four scales of the Fennema-Sherman (1976) Mathematics Attitude Scales (Confidence in Learning Mathematics, Usefulness of Mathematics, Teacher, Math as a Male Domain).

The sample for the study consisted of approximately equal numbers of girls and boys who scored at or above the mean on the test of mathematics achievement, and who were in the top quarter or bottom quarter of the distribution of confidence scores. Means and standard deviations for the four sample groups for mathematics achievement and confidence in mathematics are shown in Table 1. To test for differences between the sample groups on confidence in mathematics scores and mathematics achievement scores, analyses of variance were done using sex and confidence group as the factors, and the results are reported in Tables 2 and 3. While girls and boys did not differ significantly, the mathematics achievement mean for high confidence students was higher than the mathematics achievement mean for low confidence students. There was a statistically significant difference in reported confidence in mathematics between the high and low confidence groups, as desired, and no statistically significant difference between girls and boys.

Table 1

Means, Standard Deviations, and n's for Mathematics Achievement and Confidence by Sample Group

		Mathematics Achievement[a]		Confidence in Mathematics[b]	
	n	Mean	S.D.	Mean	S.D.
Girls					
High Confidence	20	30.5	3.3	56.7	2.6
Low Confidence	25	27.1	4.1	38.4	4.6
Boys					
High Confidence	24	30.0	3.6	56.8	2.2
Low Confidence	24	27.3	3.6	36.1	5.0

[a] Naslund, Thorpe, & LeFever, 1971; [b] Fennema & Sherman, 1976.

Table 2

ANOVA for Confidence in Mathematics
by Sex and Confidence Level
for Sample Group

Source	SS	df	MS	F	p
Sex	30.15	1	30.15	2.06	.16
Confidence Level	8870. 53	1	8870.53	604.91	.00**
Sex X Confidence Level	33.51	1	33.51	2.29	.13
Within Cell	1305.13	89	14.66		

**p < .01

Table 3

ANOVA for Mathematics Achievement by
Sex and Confidence Level
for Sample Group

Source	SS	df	MS	F	p
Sex	0.23	1	0.23	.02	.90
Confidence Level	206.01	1	206.01	15.09	.00**
Sex X Confidence Level	2.54	1	2.54	.19	.67
Within Cell	1214.92	89	13.65		

**p < .01

Subjects were located in 12 different mathematics classes taught by six teachers during Year I and in 11 mathematics classes of seven teachers during Year II. Table 4 shows the sample by school, classroom, group and year.

Observation Instruments

Teacher-Student Interaction

Several categories of interactions were identified to be observed: context of interaction (public or private), initiator of interaction (teacher or pupil), student did or did not volunteer to interact, cognitive level of the interaction, interaction concerned with student work or conduct, and teacher feedback. The Brophy-Good Dyadic Observation System (Brophy & Good, 1970) which focuses on teacher interactions with individual students, was

Table 4

Number in Each School, Classroom, and Group
Year I

Teacher-Classroom	Girls High Confidence	Girls Low Confidence	Boys High Confidence	Boys Low Confidence
I-1-A	2	3	0	2
I-2-A	3	1	2	1
I-3-A	3	1	5	1
I-3-B	3	2	1	2
I-3-C	0	2	2	4
I-4-A	1	3	3	3
I-4-B	0	3	1	4
I-5-A	2	2	4	2
I-5-B	1	2	0	2
I-6-A	2	3	1	2
I-6-B	1	2	2	0
I-6-C	2	1	3	1
All Classrooms	20	25	24	24

Year II

Teacher-Classroom	Girls High Confidence	Girls Low Confidence	Boys High Confidence	Boys Low Confidence
II-1-A	2	2	3	0
II-2-A	4	0	3	2
II-3-A	0	3	0	0
II-3-B	1	1	0	1
II-4-A	1	0	0	3
II-4-B	2	1	2	2
II-5-A	4	1	4	2
II-6-A	1	5	2	3
II-6-B	2	1	2	0
II-7-A	1	1	3	4
II-7-B	2	5	3	3
All Classrooms				

modified to incorporate the categories above. A more detailed description of the observation system is in the Observer Manual in Appendix A.

In this instrument, as interactions occur they are recorded on a data sheet designed to be scanned by machine. The data sheet has a space to mark indicating which target student was involved in each interaction and spaces to mark to describe the interaction (e.g. Public or Private, Student Initiator, Teacher Initiator, etc.). A copy of the data sheet is in Appendix B.

The listing of teacher-student interaction observation categories are in Table 5, and fit into three broad categories: (1) public interactions, (b) private interactions, and (c) teacher comments. Public interactions occur when the attention of the class is on the teacher and on the interaction. Private interactions occur when the attention of the class is not on the interaction. Generally, public interactions happen during class discussion and large group teaching, while private interactions happen during times when students are involved in individual seatwork.

Engaged Time

Data concerning target students' engaged time in mathematics and three characteristics of the learning tasks in which they were engaged were collected using a coding system adapted from one developed by Romberg, Small, Carnahan, and Cookson (Note 8). The system uses a time sampling procedure which consists of a schedule for rotating the observation of each target student in the class, allowing 30 seconds per student. During the 30 seconds allowed, the first 20 seconds are used by the observer to get ready to record the behaviors of the student at the 20th second, or sampled moment, of the 30 second period. Seconds 21 through 30 of the 30 second period are used to

Table 5

Teacher-Student Interaction Observation Categories

Interactions	
Public	Private
Initiator	**Student-Initiated Work**
Teacher	Praise
Student	Higher Level
Response Opportunity	Lower Level
Discipline Question	Criticism
Direct-No Volunteer	Don't Know
Open-Volunteer	**Student-Initiated Procedural**
Callout	Praise
Level of Question	Neutral
Higher Level	Criticism
Lower Level	**Teacher-Initiated Work**
Non-Mathematics	Praise
Student Answer	Higher Level
Correct	Lower Level
Part Correct	Criticism
Incorrect	Don't Know
No Response	**Teacher-Initiated Procedural**
Teacher Feedback	All
Positive	
Neutral	
Negative	
Sustaining	

Public or Private Interactions
Teacher-Initiated Behavioral
Praise
Criticism

record the proper codes which describe the behavior of the target student at the sampled moment. The observation in a specified order of all target students in a class followed by a 30 second rest period was called a cycle. After each five cycles, observers take a one-minute break. These observations are recorded on a machine scanned coding sheet (Appendix B). The observer manual (Appendix A) contains greater detail. The engaged time observation categories were: (a) Absent, (b) Engaged or non-engaged in mathematics, (c) High or Low cognitive level, (d) Spatial or non-spatial, and (e) Peer or non-peer.

Data Collection

Observer Training

Observers were carefully selected and trained prior to gathering both the Year I and Year II data. They were paid for training as well as observation time. Each teacher-student interaction and engaged time observer had had classroom teaching experience.

The teacher-student interaction observers were trained each year during a two week block in daily two hour sessions. The first three days were spent understanding the categories of the coding system and practicing the use of categories on transcripts and videotapes of 7th grade mathematics classes. The remaining days were spent practicing the coding system in actual middle school mathematics classes not in the study. On the first day of training, the study was described to the observers. To avoid giving observers reason to have any expectations of how certain students might act, the procedure of the study was explained, but the hypotheses and questions for the study were not given. Neither were the criteria given for the selection of the sample. Observer manuals and machine readable data sheets were handed out and described in general. The public categories of the teacher-student interaction coding system were described in detail, including the definitions of the categories and the rules used in distinguishing one category from another. The remainder of the day was spent practicing the coding system on interactions available from a transcript of a seventh grade mathematics class. Observers were asked to read the observer manual by the next day.

The second day of teacher-student interaction observer training began with discussion of the public categories introduced the previous day. Questions that arose from the reading of the manual were also discussed. More time was spent practicing coding with the transcript of the seventh grade mathematics class. Next, observers attempted to record the teacher-student interaction from a videotape of a seventh grade mathematics class. Coding of both the transcription and the videotape allowed plenty of opportunity to present examples of categories and discuss distinctions between categories. The rest of the time was spent describing the categories for teachers' comments and how to record the occurrence of the teacher behaviors of interest in these categories.

The third day of training began with discussion of questions from the work done on the first and second days of training, and the private categories were explained in detail. The majority of the time on day three was spent practicing the entire coding system with videotapes of a seventh grade mathematics class.

The remaining days of training were spent practicing the observation system in middle school mathematics classes. Each day, a similar routine was followed. Observers met before the beginning of the class to discuss any questions about observation categories. All the observers then sat in the back of the classroom, identified (among the observers only) which students would be observed, and coded all of the teacher-target student interactions for most of the class period. After the class ended, or after the observers had coded sufficient interactions for the day, all of the observers left the classroom and spent time comparing their coding of the classroom interactions. In this way, observers learned the coding system, obtained practice using the system, and became accustomed to being in middle school mathematics classes. Training was continued for each observer until their percent agreement with the researcher was at least 70 percent in each category.

Both years, the engaged time observers were also trained in daily two-hour sessions which met separately from the teacher-student interaction observation training. First, the study was described in similar detail as had been used with the teacher-student interaction observers. The procedure for the study was described. However, neither the purpose of the study nor the method used in selecting the sample were explained to the observers. The method of time sampling was described in detail. Copies of the machine scorable data sheet were handed out and the different sections of the form were described. The time sampling procedure was explained with a demonstration of the actual timing. The categories were described along with the method to use in filling in the coding sheet. The observers practiced the engaged time observation system by coding portions of videotape of a seventh grade mathematics class. Each observer received a training manual and was asked to read the manual before the next day.

The second day of engaged time observer training began with a review and discussion of the time sampling procedure and the observation categories.

Most of the session was spent practicing the system by coding videotapes of a mathematics class. Subsequent training sessions were conducted in schools practicing the engaged time observation live in sixth and seventh grade mathematics classes. These sessions included detailed discussions of the distinctions between categories. After two of classroom practice, the percent agreement between each observer and the researcher was checked. Training continued until each observer reached at least 70 percent agreement with a criterion observer for each category.

Data Collection

It was planned that all Year I observation data would be gathered between January 7, 1980 and February 29, 1980. Six classes were to be observed during the four weeks from January 7 to February 1, and the remaining six classes were to be observed from February 4 to February 29. Six classes were observed as planned beginning January 7. During the week of January 28, one teacher to be observed beginning February 4 gave notice of his resignation to be effective on February 4. Thus, only three classes were observed from February 4 to February 29. The observation of the other three classes was postponed for four weeks until March 3 to March 28. During Year II, six classes were observed January 19-February 13, 1981, and five classes were observed February 16-March 12, 1981.

Observer Agreement

Teacher-Student Interaction

Percent agreement for each observation category was obtained between each observer and a criterion observer before data collection to determine that observers had learned the system adequately and during data collection to ensure that observers had maintained their accurate use of the coding system. To check agreement the observer and criterion observer coded the same students and teacher at the same time in a middle school mathematics classroom.

Once the classroom had been coded, the observer's data were compared to that of the criterion observer. The first step consisted of checking what percent of the total number of interactions coded by the criterion observer were also coded by the observer. This was computed as number of agreements divided by total number of interactions coded times 100. This is the percent agreement for identification of interactions. Next, a comparison was made in each observation category between observer and criterion observer for all the interactions which had been identified by both observer and criterion observer. For each observation category, the number of agreements divided by agreements plus disagreements multiplied by 100 yielded percent agreement for the category. For Year I, all observation category agreement checks for interactions which occurred frequently was higher than 78%. Complete data on Observer Agreement are in Appendix C.

Engaged Time

Percent agreement between individual observers and a criterion observer was also obtained for engaged time observation categories. As for teacher-student interaction, agreement checks were used during training to determine when observers had learned the coding system well enough to collect data and during data collection to be certain that observers maintained a high level of accuracy. To check agreement, the observer and criterion coded a classroom together observing the same students at the same moments.

After coding, the data of the observer were compared to that of the criterion for each category. Percent agreement in each category was determined by dividing the number of cycles across students with agreement by the number of agreements plus disagreements multiplied by 100. All agreements for each engaged time observation category were greater than 56% with the exception of one category (Complete data are in Appendix C).

Data Analyses and Results

Teacher-Student Interactions

Data sheets marked by observers were checked soon after the collection of data to be sure that observers were using correct procedures. When all data had been collected, sheets were checked again to ensure that teacher, student, and observer identification numbers were accurately recorded. The data sheets were then machine read by an optical scanner at Wisconsin Testing and Evaluation and the data were placed on computer tape.

The data for all categories were first recorded so that the interactions for target students for each observation day were in the order the interactions had occurred in the classroom. The data were then reorganized in a computer file so that for each public and private observation category, a mean frequency per day for each student could be calculated. These values were produced by summing an individual target student's raw frequencies for each public and private observation category across days and dividing by the number of days that student was observed. Group means and standard deviations were formed for the various sample groups by using the mean frequency per day values.

These means and standard deviations for Public Interaction Categories by sex, confidence level, and year are in Table 6. Similar statistics for Private Interaction Categories are in Table 7. Two way analysis of variance were done for each observation category using sex, confidence level, and year as factors and the resulting F-ratios, degrees of freedom, and probability levels are in Tables 8 and 9.

Table 6

Means and Standard Deviations of Frequencies per Day for Public Teacher-Student Interaction Categories by Sex, Confidence Level, and Year

	YEAR I								YEAR II							
	Girls				Boys				Girls				Boys			
	High[a] Confidence		Low[b] Confidence		High[c] Confidence		Low[d] Confidence		High[a] Confidence		Low[b] Confidence		High[c] Confidence		Low[d] Confidence	
	x	(sd)	x	(sd)	x	(sd)	x	(sd)	x	(sd)	x	(sd)	x	(sd)	x	(sd)
Total Interactions																
Public	1.05	(.50)	1.18	(1.21)	2.08	(2.06)	1.58	(1.27)	.49	(.38)	.65	(1.05)	1.06	(1.61)	.95	(.73)
Initiator																
Teacher	.93	(.53)	.88	(.80)	1.50	(1.20)	1.21	(.98)	.41	(.34)	.38	(.46)	.59	(.75)	.66	(.52)
Student	.11	(.18)	.30	(.48)	.57	(1.01)	.37	(.42)	.07	(.12)	.26	(.67)	.48	(.92)	.29	(.39)
Response Opportunity																
Discipline Question	.01	(.02)	.00	(.00)	.01	(.04)	.01	(.02)	.00	(.00)	.00	(.01)	.02	(.06)	.01	(.02)
Direct-No Volunteer	.37	(.21)	.25	(.19)	.37	(.23)	.27	(.20)	.24	(.30)	.09	(.17)	.14	(.25)	.22	(.25)
Open Volunteer	.42	(.36)	.57	(.57)	.94	(.91)	.81	(.72)	.16	(.18)	.30	(.45)	.33	(.45)	.35	(.37)
Callout	.06	(.17)	.19	(.50)	.42	(.86)	.23	(.39)	.03	(.08)	.21	(.47)	.47	(.89)	.33	(.43)
Level of Question																
Higher Level	.14	(.10)	.16	(.27)	.30	(.36)	.25	(.31)	.06	(.07)	.16	(.48)	.22	(.49)	.11	(.13)
Lower Level	.86	(.45)	.93	(1.00)	1.50	(1.33)	1.21	(1.03)	.35	(.27)	.45	(.55)	.64	(.79)	.74	(.66)
Non-Mathematics	.05	(.10)	.09	(.14)	.27	(.54)	.12	(.12)	.08	(.16)	.04	(.11)	.21	(.52)	.10	(.13)
Student Answer																
Correct	.72	(.40)	.69	(.63)	1.04	(.76)	.85	(.68)	.32	(.32)	.31	(.39)	.43	(.56)	.51	(.41)
Part Correct	.08	(.09)	.06	(.08)	.14	(.20)	.11	(.14)	.03	(.06)	.02	(.03)	.04	(.08)	.04	(.06)
Incorrect	.09	(.10)	.09	(.10)	.17	(.24)	.17	(.16)	.02	(.03)	.05	(.07)	.10	(.15)	.09	(.11)
No Response	.04	(.06)	.03	(.07)	.07	(.10)	.07	(.09)	.05	(.08)	.02	(.04)	.03	(.05)	.04	(.08)
Teacher Feedback																
Positive	.42	(.26)	.37	(.39)	.63	(.56)	.50	(.51)	.16	(.13)	.24	(.34)	.33	(.38)	.35	(.31)
Neutral	.76	(.34)	.89	(.93)	1.55	(1.54)	1.04	(.81)	.33	(.35)	.35	(.62)	.61	(1.04)	.49	(.39)
Negative	.11	(.15)	.11	(.12)	.22	(.28)	.19	(.20)	.02	(.04)	.07	(.15)	.12	(.27)	.11	(.15)
Sustaining	.21	(.16)	.18	(.31)	.37	(.50)	.31	(.48)	.07	(.08)	.06	(.08)	.10	(.13)	.09	(.10)

[a] _n_ = 20, [b] _n_ = 20, [c] _n_ = 22, [d] _n_ = 20

Table 7

Means and Standard Deviations of Frequencies per day for Private Teacher-Student Interaction Categories by Sex, Confidence Level, and Year

	YEAR I															
	Girls				Boys				Girls				Boys			
	High[a] Confidence		Low[b] Confidence		High[c] Confidence		Low[d] Confidence		High[a] Confidence		Low[b] Confidence		High[c] Confidence		Low[d] Confidence	
	x	(sd)	x	(sd)	x	(sd)	x	(sd)	x	(sd)	x	(sd)	x	(sd)	x	(sd)
Total Interactions																
Private	.77	(.47)	.66	(.52)	.94	(.86)	.72	(.56)	1.46	(.95)	1.62	(1.36)	1.46	(1.08)	1.28	(1.10)
Initiator																
Teacher	.19	(.22)	.22	(.21)	.22	(.21)	.18	(.16)	.29	(.25)	.33	(.26)	.33	(.25)	.31	(.28)
Student	.59	(.36)	.45	(.42)	.72	(.73)	.54	(.46)	1.18	(.79)	1.29	(1.18)	1.14	(.94)	.97	(.89)
Student Initiated Work																
Praise	.01	(.02)	.01	(.04)	.00	(.01)	.00	(.02)	.01	(.02)	.01	(.03)	.01	(.03)	.03	(.05)
Higher Level	.08	(.15)	.06	(.09)	.07	(.12)	.08	(.14)	.23	(.24)	.21	(.32)	.18	(.23)	.18	(.27)
Lower Level	.30	(.23)	.25	(.31)	.30	(.29)	.29	(.30)	.60	(.50)	.77	(.76)	.61	(.46)	.62	(.56)
Criticism	.01	(.02)	.00	(.02)	.01	(.03)	.01	(.03)	.00	(.02)	.02	(.05)	.02	(.05)	.02	(.04)
Don't Know	.06	(.08)	.05	(.13)	.13	(.27)	.04	(.06)	.08	(.10)	.10	(.18)	.09	(.16)	.05	(.06)
Student-Initiated Procedural																
Praise	.00	(.01)	.00	(.01)	.00	(.01)	.00	(.00)	.00	(.02)	.01	(.03)	.00	(.00)	.00	(.02)
Neutral	.16	(.16)	.10	(.11)	.22	(.33)	.14	(.15)	.27	(.30)	.21	(.19)	.26	(.30)	.12	(.14)
Criticism	.00	(.01)	.00	(.01)	.01	(.02)	.02	(.03)	.00	(.02)	.00	(.00)	.02	(.04)	.01	(.03)
Teacher-Initiated Procedural																
All	.04	(.07)	.10	(.10)	.08	(.09)	.05	(.06)	.12	(.14)	.13	(.10)	.14	(.13)	.15	(.16)

[a]n = 20, [b]n = 20, [c]n = 22, [d]n = 20

Table 8

F-ratios and Probability Levels from ANOVAs by Sex, Confidence Level, and Year for Public Teacher-Student Interaction Categories

Category	Sex[a]		Confidence[b]		Year[c]		sxc[d]		sxy[e]		cxy[f]		sxcxy[g]	
	F	p	F	p	F	p	F	p	F	p	F	p	F	p
Total Interactions														
Public	5.19	.03*	.10	.76	41.45	.00**	.79	.38	1.64	.21	.91	.34	.67	.41
Initiator														
Teacher	5.36	.02*	.26	.61	57.03	.00**	.04	.83	1.83	.18	1.36	.25	1.06	.31
Student	3.48	.07	.00	.99	1.70	.20	2.33	.13	.23	.63	.01	.94	.00	.95
Response Opportunity														
Discipline Question	4.13	.05*	1.10	.30	.24	.63	.59	.45	.84	.36	.08	.78	2.43	.12
Direct-No Volunteer	.14	.71	3.28	.07	23.81	.00**	2.18	.15	.00	.96	1.70	.20	3.02	.09
Open Volunteer	5.60	.02*	.20	.66	41.12	.00**	.94	.34	4.81	.03*	.29	.59	.37	.55
Callout	4.79	.03*	.00	.96	.51	.48	2.11	.15	.60	.44	.14	.71	.00	.97
Level of Question														
Higher Level	2.18	.14	.03	.86	3.80	.06	1.34	.25	.98	.33	.03	.87	1.03	.31
Lower Level	5.23	.03*	.00	.99	48.35	.00**	.31	.58	1.01	.32	1.61	.21	1.24	.27
Non-Mathematics	3.84	.05*	1.29	.26	.83	.37	1.29	.26	.20	.66	.15	.70	.93	.34
Student Answer														
Correct	3.72	.06	.13	.72	49.41	.00**	.03	.86	.44	.51	1.35	.25	1.09	.30
Part Correct	3.96	.05*	.66	.42	23.52	.00**	.00	.99	1.61	.21	.35	.55	.07	.80
Incorrect	7.60	.01**	.04	.85	14.44	.00**	.19	.66	.72	.40	.04	.84	.56	.46
No Response	1.30	.26	.08	.78	2.78	.10	.78	.38	3.64	.06	.11	.74	.39	.53
Teacher Feedback														
Positive	4.41	.04	.07	.79	25.88	.00**	.23	.63	.14	.71	2.79	.10	.01	.94
Neutral	4.13	.05	.50	.48	48.31	.00**	1.33	.25	2.14	.15	.60	.44	1.91	.17
Negative	5.67	.02	.00	.99	11.26	.00**	.28	.60	.31	.58	.45	.51	.17	.68
Sustaining	3.31	.07	.27	.61	23.69	.00**	.03	.86	1.87	.18	.13	.72	.04	.84

[a] df(1,78), [b] df(1,78), [c] df(1,78), [d] df(1,78), [e] df(1,78), [f] df(1,78), [g] df(1,78), *p < .05, **p < .01

Table 9

F-ratios and Probability Levels from ANOVAs by Sex, Confidence Level, and Year for Private Teacher-Student Interaction Categories

Category	Sex[a]		Confidence[b]		Year[c]		sxc[d]		sxy[e]		cxy[f]		sxcxy[g]	
	F	p	F	p	F	p	F	p	F	p	F	p	F	p
Total Interactions														
Private	.03	.87	.32	.58	30.88	.00**	.48	.49	1.30	.26	.39	.53	.22	.64
Initiator														
Teacher	.03	.86	.00	.95	9.96	.00**	.88	.35	.03	.87	.04	.85	.00	.99
Student	.06	.81	.47	.50	31.25	.00**	.33	.57	2.12	.15	.44	.51	.32	.57
Student-Initiated Work														
Praise	.19	.66	3.17	.08	3.00	.09	.08	.78	4.02	.0[illegible]	1.60	.21	.78	.38
Higher Level	.23	.63	.04	.85	17.61	.00**	.14	.71	.56	.46	.00	.99	.00	.97
Lower Level	.11	.75	.16	.69	30.77	.00**	.16	.69	.46	.50	.87	.35	.57	.45
Criticism	1.22	.27	.44	.51	2.84	.10	.73	.40	.01	.92	.16	.69	2.52	.12
Don't Know	.11	.74	1.44	.23	.25	.62	2.17	.15	1.16	.29	.96	.33	.09	.77
Student-Initiated Procedural														
Praise	1.98	.16	.83	.36	.94	.34	.33	.57	.41	.52	1.71	.20	.01	.91
Neutral	.01	.93	4.01	.05*	5.14	.03*	.52	.47	3.76	.06	.35	.55	.21	.65
Criticism	6.74	.01**	.49	.49	.04	.84	.08	.78	.01	.92	1.67	.20	.73	.40
Teacher-Initiated Procedural														
All	.21	.65	.17	.68	15.97	.00**	1.37	.24	.37	.54	.08	.77	1.42	.24

[a] df(1,78), [b] df(1,78), [c] df(1,78), [d] df(1,78), [e] df(1,78), [f] df(1,78), [g] df(1,78), $*p < .05$, $**p < .01$

Several things are quickly apparent from an inspection of Tables 6-9. There are many significant sex differences in the mean frequency per day of Public Teacher-Student Interactions with boys participating in many more interactions with teachers than do girls (Total Interactions). Teachers initiate more interactions with boys, (significant at .05 level), ask boys more questions for discipline purposes, ask boys more higher, lower, and more non-mathematics questions. Boys appear to be more active initiators of interactions. They volunteer more to answer questions and to call out responses without waiting for teacher recognition.

These observed patterns of behavior were seen during both years. Although many significant year affects were found which indicate that 7th and 8th grade teachers interact with students differently, no significant sex x year interactions were found. No significant effects for confidence level were found.

The same pattern of sex-related differences on teacher-pupil interactions for private interactions was not observed. Once again, significant effects for year were found, but few significant effects for sex or confidence level were seen.

Since this was a true longitudinal study with the same subjects being observed both years, the plots of the group means give added insight to the statistical analyses.* Figure 1 shows clearly that both groups of boys participated in more interactions than did either group of girls and Figure 2 shows the same for Public Interactions. In both cases, the High Confidence females are participating in the fewest interactions and High Confidence males are participating in the most. Few differences are seen in number of Private Interactions (Figure 3).

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*Plots are found in text or in Appendices D & E.

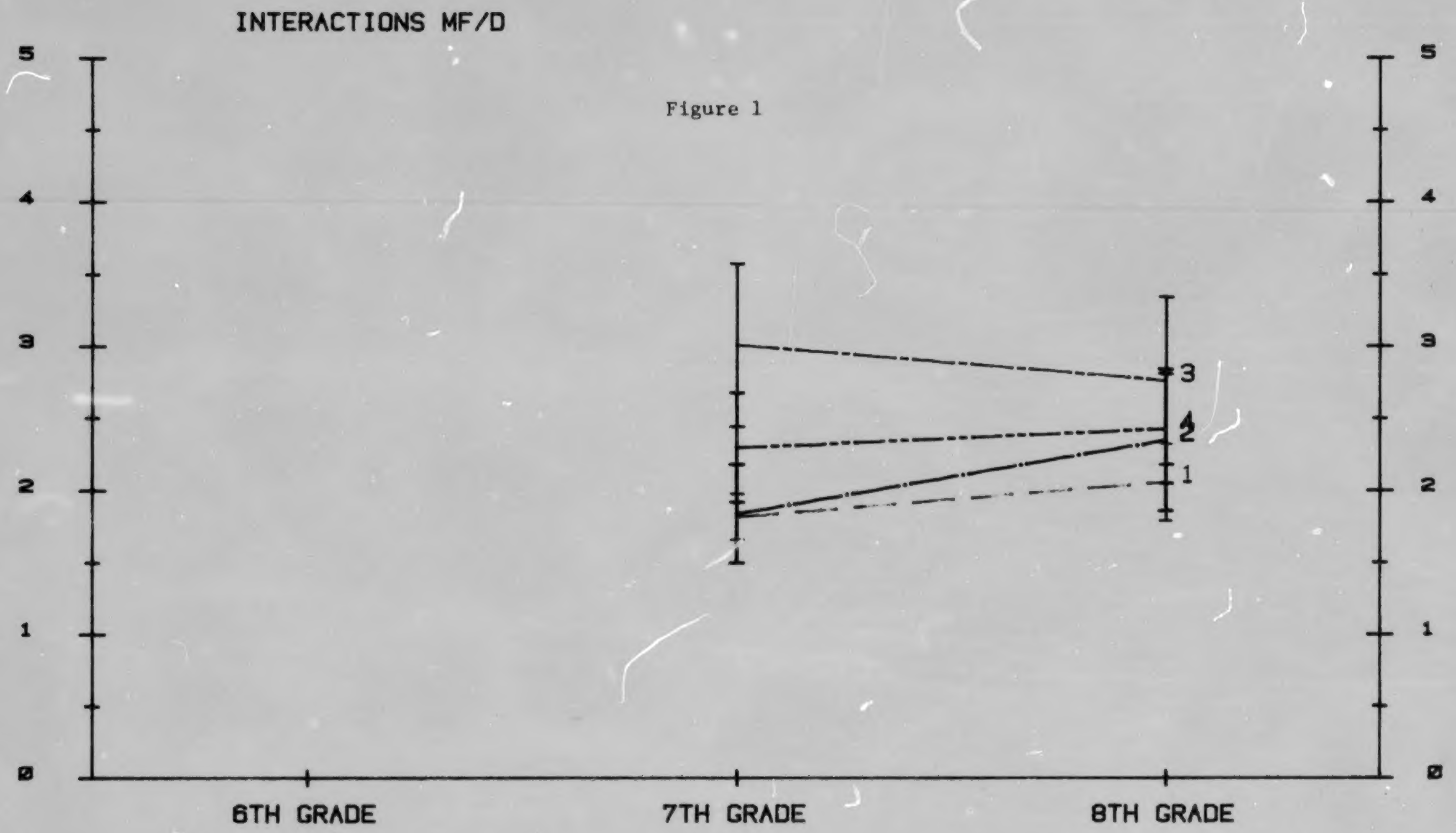
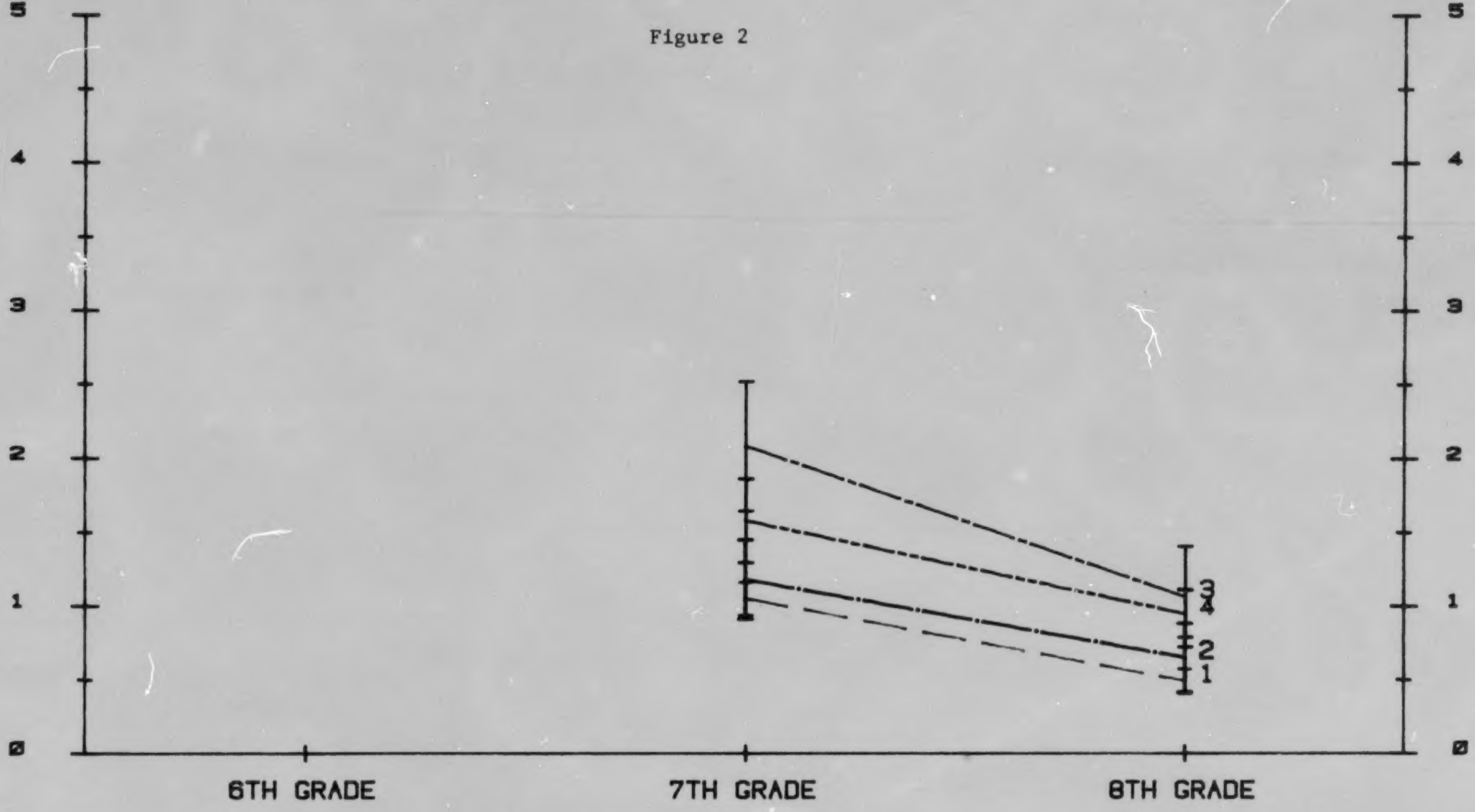


Figure 1

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	—· — —	FEMALE HIGH CONF	*	1.82	2.06
2	——·——	FEMALE LOW CONF	*	1.84	2.35
3	——·——	MALE HIGH CONF	*	3.01	2.76
4	-·-·-·-·-	MALE LOW CONF	*	2.30	2.43

PUBLIC INTERACTIONS MF/D

Figure 2

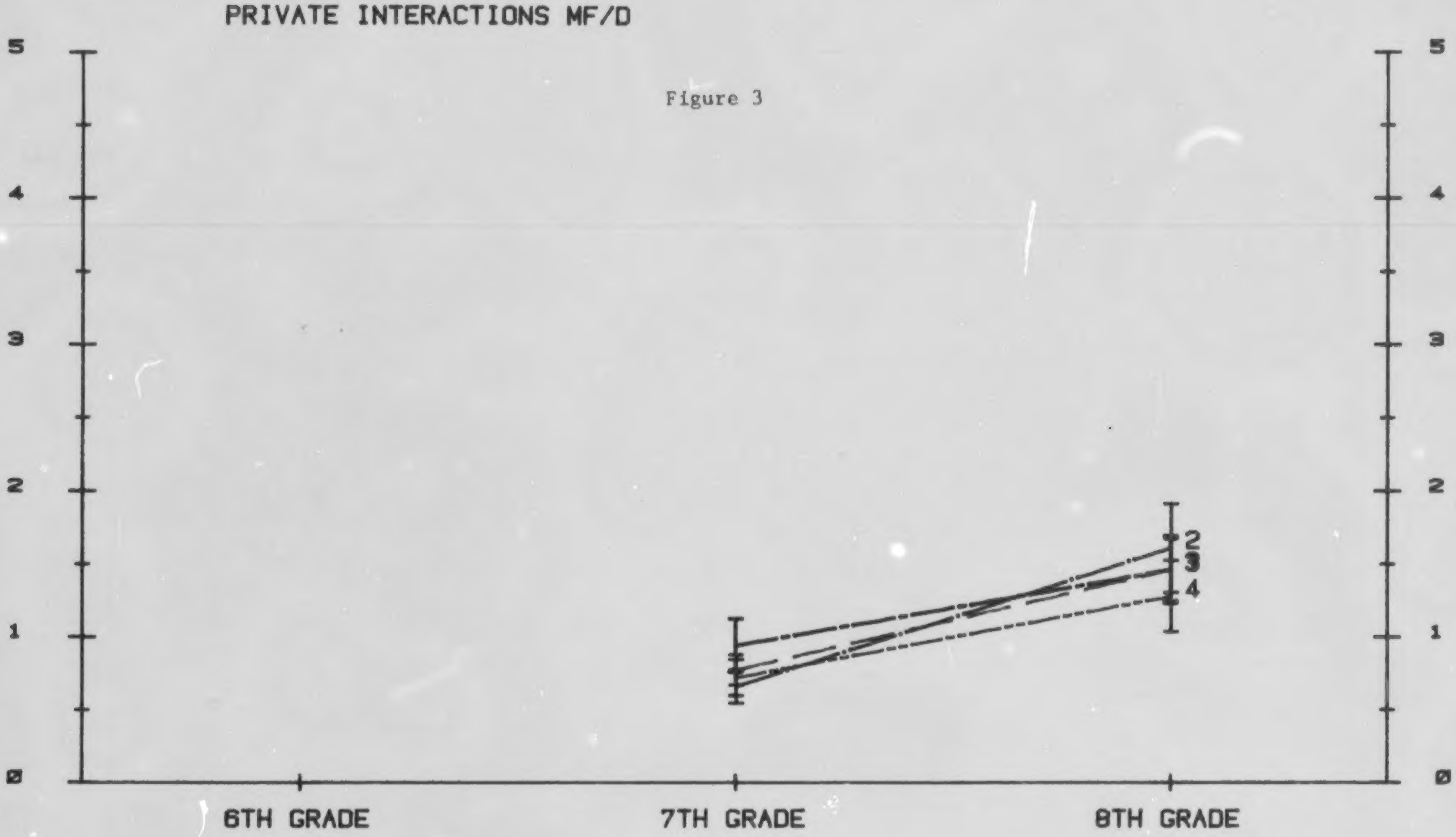


#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	1.05	.49
2	——-——	FEMALE LOW CONF	*	1.18	.65
3	—-·-—	MALE HIGH CONF	*	2.08	1.06
4	—·-·-·	MALE LOW CONF	*	1.58	.95

ut 35

36

Figure 3



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.77	1.46
2	—·—·—	FEMALE LOW CONF	*	.66	1.61
3	——-——	MALE HIGH CONF	*	.94	1.46
4	-·-·-·-·	MALE LOW CONF	*	.72	1.28

Another interesting way of looking at overall interactions is to inspect the number of days with No Interactions. Keep in mind that these groups of students were observed each year 15-20 days. Figure 4 shows that both years, low confidence girls did not participate in any interactions more often than any other group with low confidence boys the next highest group both years. Both groups of girls participated in no public interactions about 50% of the observational days. Low confidence girls and boys did not interact with the teacher privately as often as did high confidence students.

The question that always comes to mind as one studies teacher/pupil interactions is direction of causation. Is the teacher the one who is dominant in determining who s/he interacts with, or is the teacher only a reactor and the students determine who s/he interacts with, of course, neither teacher nor student is always the reason for all interactions and each contributes causation. However, it is interesting to break down the data in such a way that some information can be gained about teacher behavior and student behavior.

Teacher Behavior

The plots of means help in describing teachers' behaviors. Teachers initiate more public interactions with boys than with girls* (Figure 7), but about the same number of private interactions with girls and boys (Figure 8). Teachers asked boys more non-academic questions* (Figure 9) and more low level questions (Figure 10).* High confidence boys were asked more high level questions than any other group (Figure 11). One other thing should be noted. High Confidence girls often participate in fewer interactions than any other group (Total Interactions, Public Interactions, Private Initiated by Teacher, Non-academic Question, Low Level Questions, and High Level Questions).

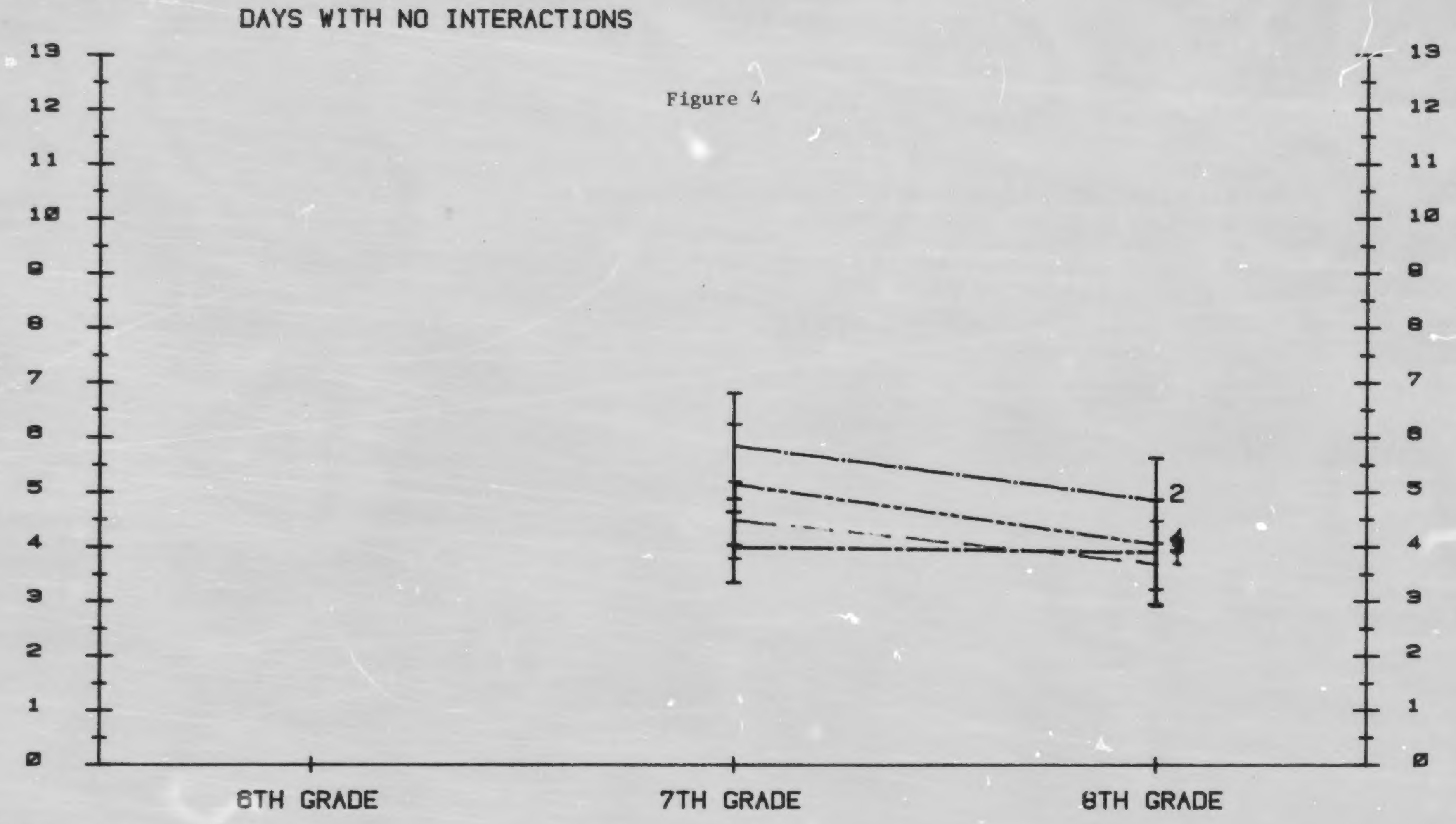


Figure 4

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	4.50	3.70
2	——·——·—	FEMALE LOW CONF	*	5.85	4.85
3	—·—·—·—	MALE HIGH CONF	*	4.00	3.91
4	-·-·-·-·-	MALE LOW CONF	*	5.15	4.05

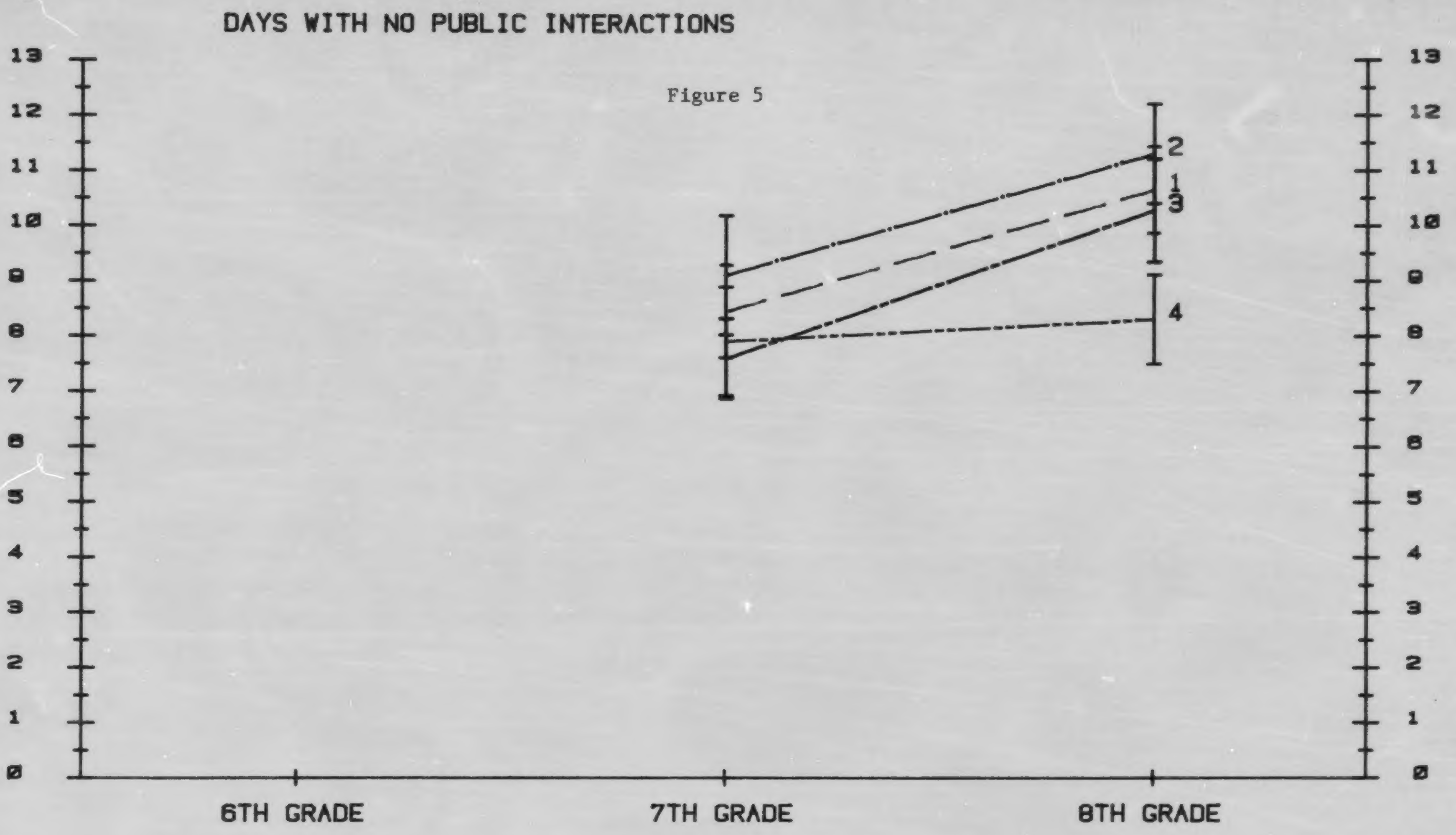
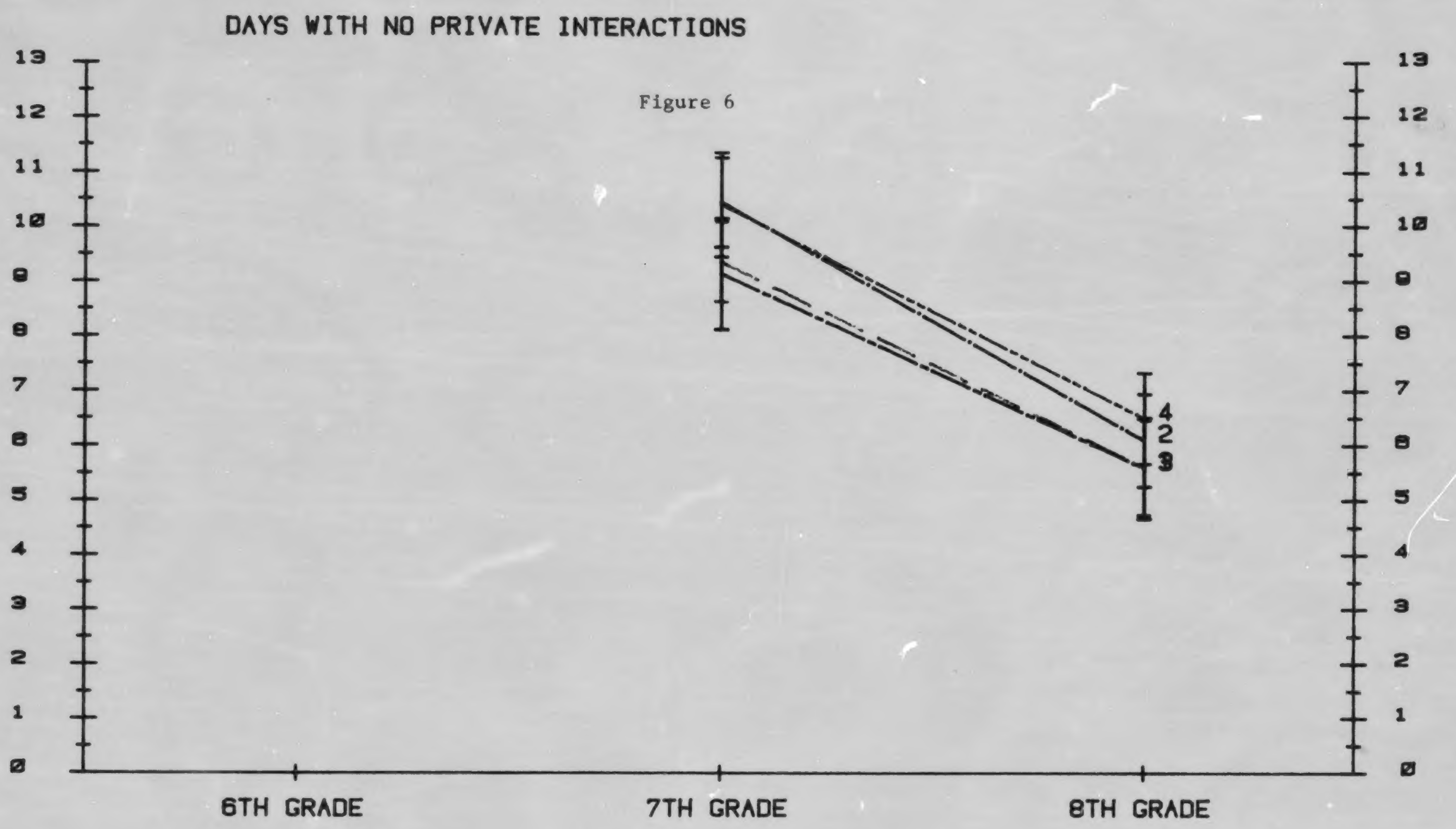


Figure 5

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	8.45	10.65
2	—·—·—	FEMALE LOW CONF	*	9.10	11.30
3	———	MALE HIGH CONF	*	7.59	10.27
4	-·-·-·-	MALE LOW CONF	*	7.90	8.30

Figure 6



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	9.35	5.60
2	—·—·—	FEMALE LOW CONF	*	10.45	6.10
3	—·—·—	MALE HIGH CONF	*	9.14	5.59
4	-·-·-·-	MALE LOW CONF	*	10.40	6.50

PUBLIC INITIATED BY TEACHER MF/D

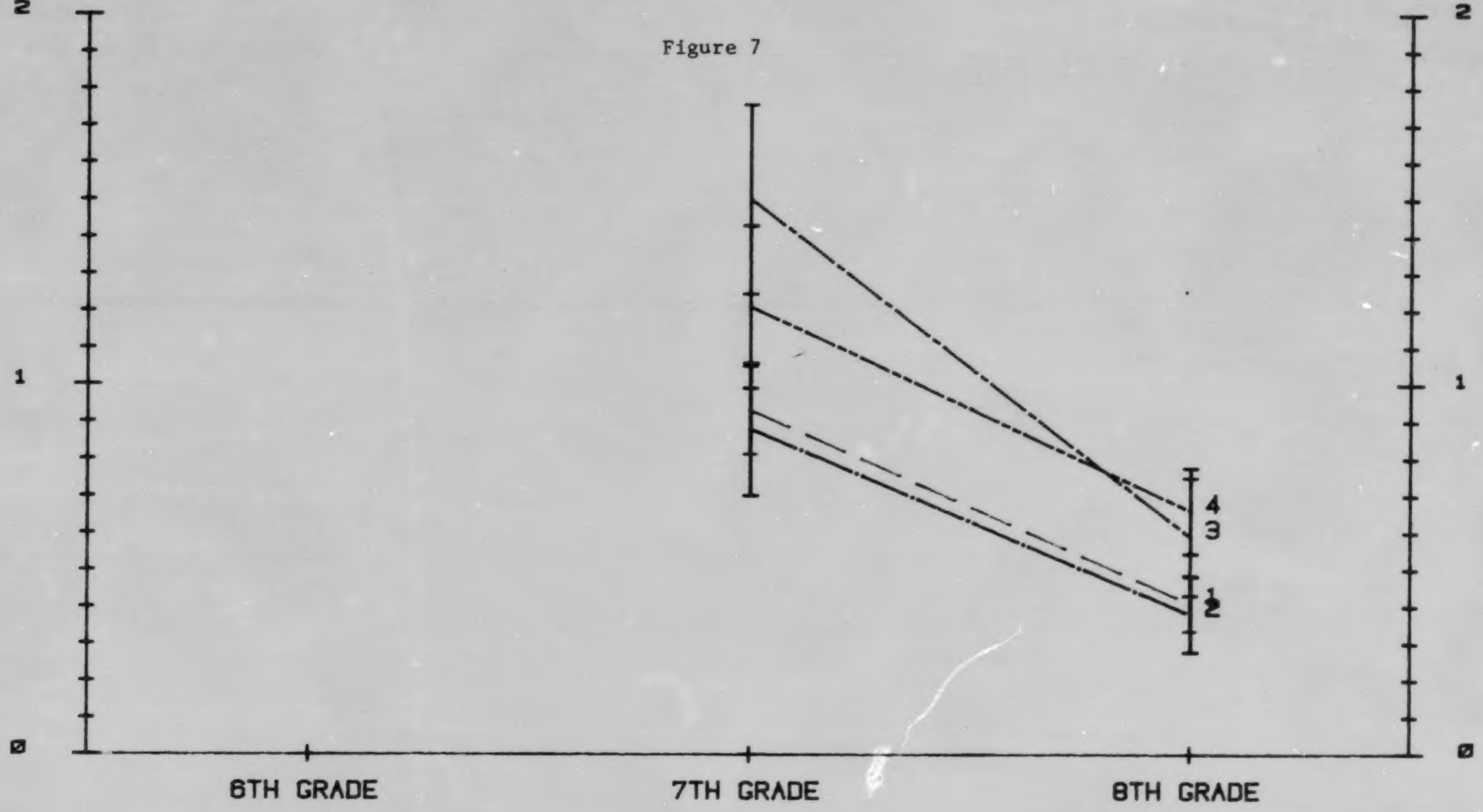
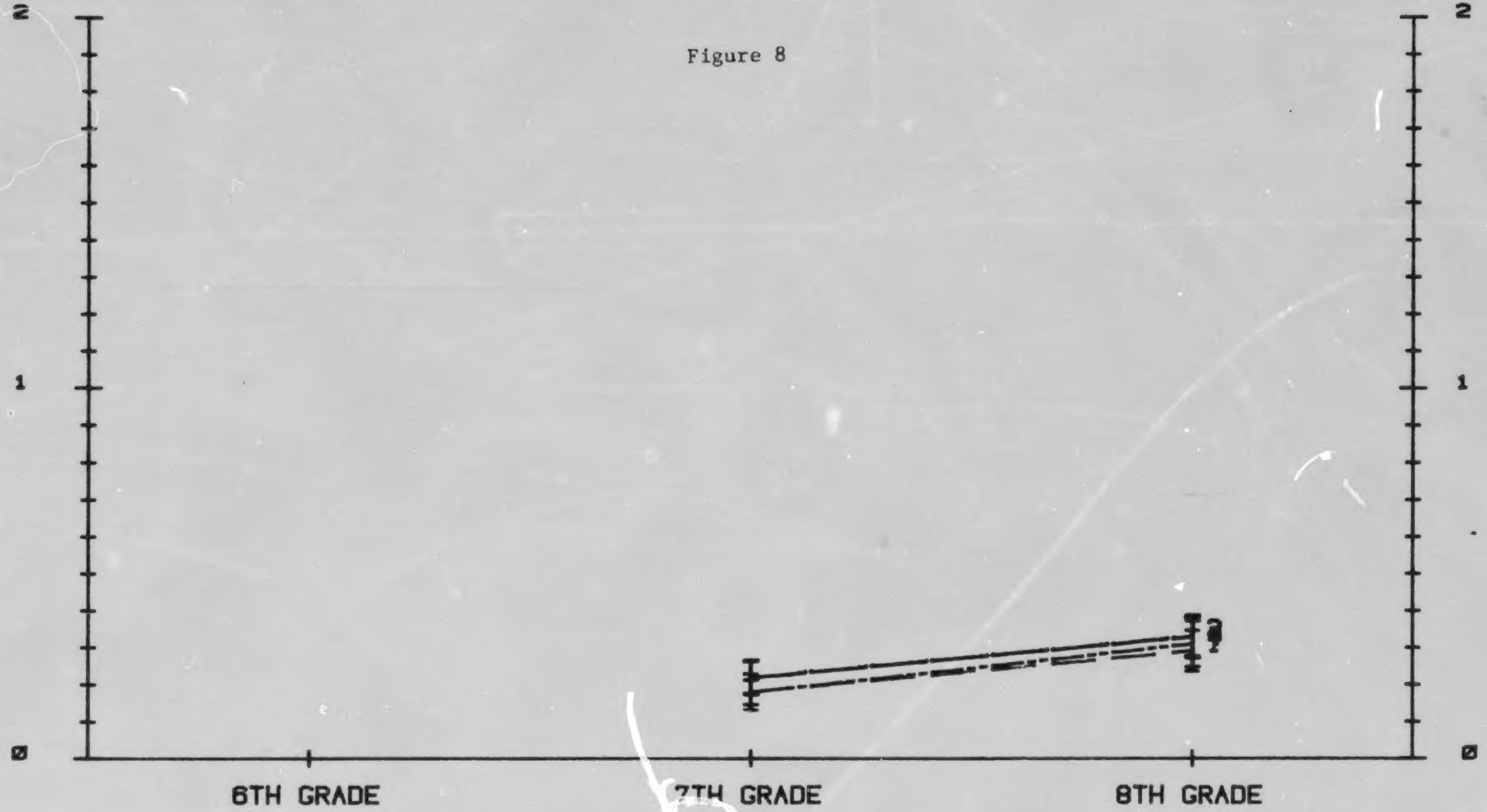


Figure 7

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.93	.41
2	——·——	FEMALE LOW CONF	*	.88	.38
3	—·—·—	MALE HIGH CONF	*	1.50	.59
4	-·-·-·-	MALE LOW CONF	*	1.21	.66

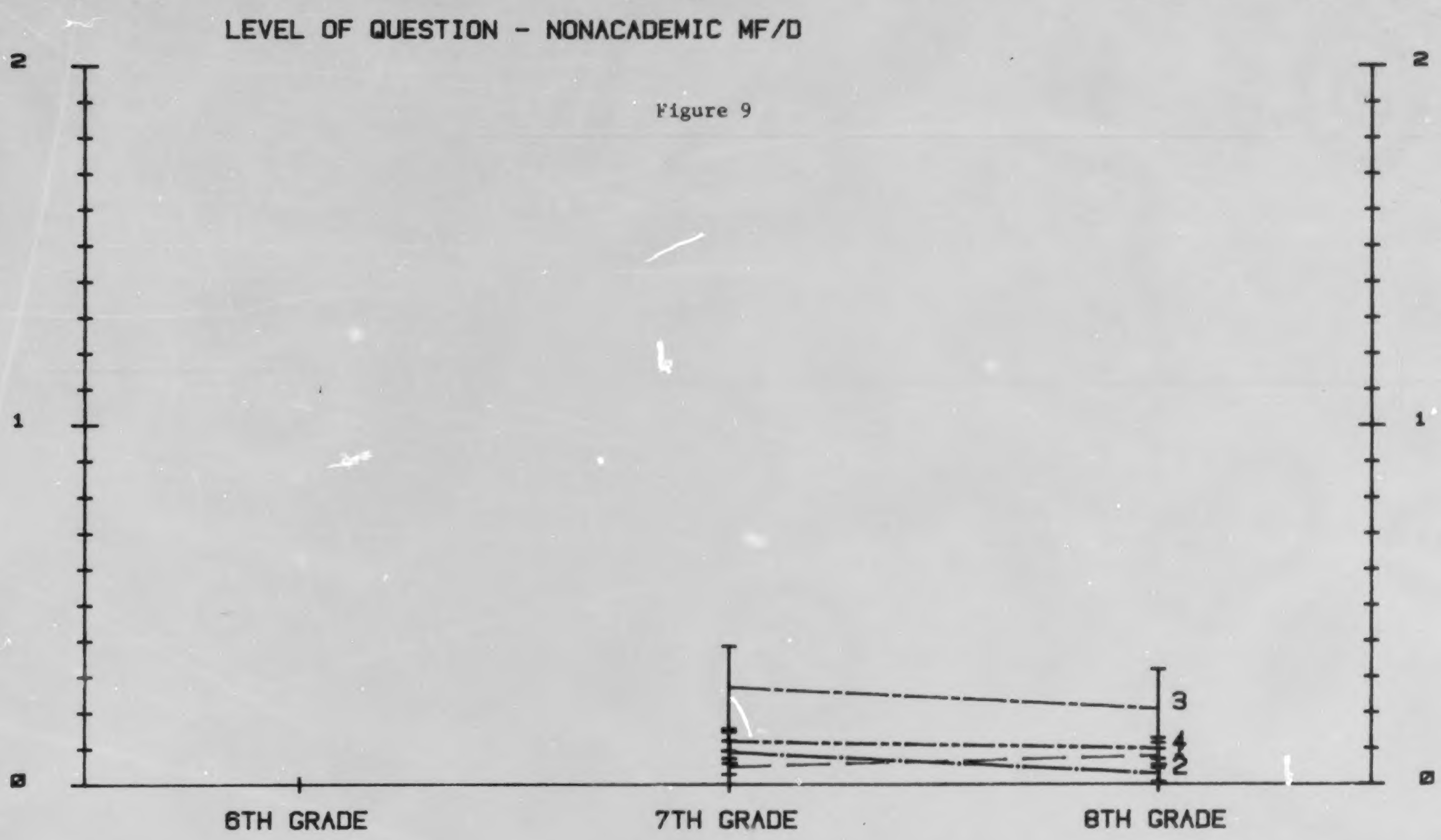
PRIVATE INITIATED BY TEACHER MF/D

Figure 8



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.18	.29
2	—·—·—	FEMALE LOW CONF	*	.22	.33
3	—-—-—	MALE HIGH CONF	*	.22	.33
4	-·-·-·-·-	MALE LOW CONF	*	.18	.31

Figure 9



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.05	.08
2	——·——	FEMALE LOW CONF	*	.09	.03
3	——-·——	MALE HIGH CONF	*	.27	.21
4	—-·-·-·-·-	MALE LOW CONF	*	.12	.10

LEVEL OF QUESTION - LOW MF/D

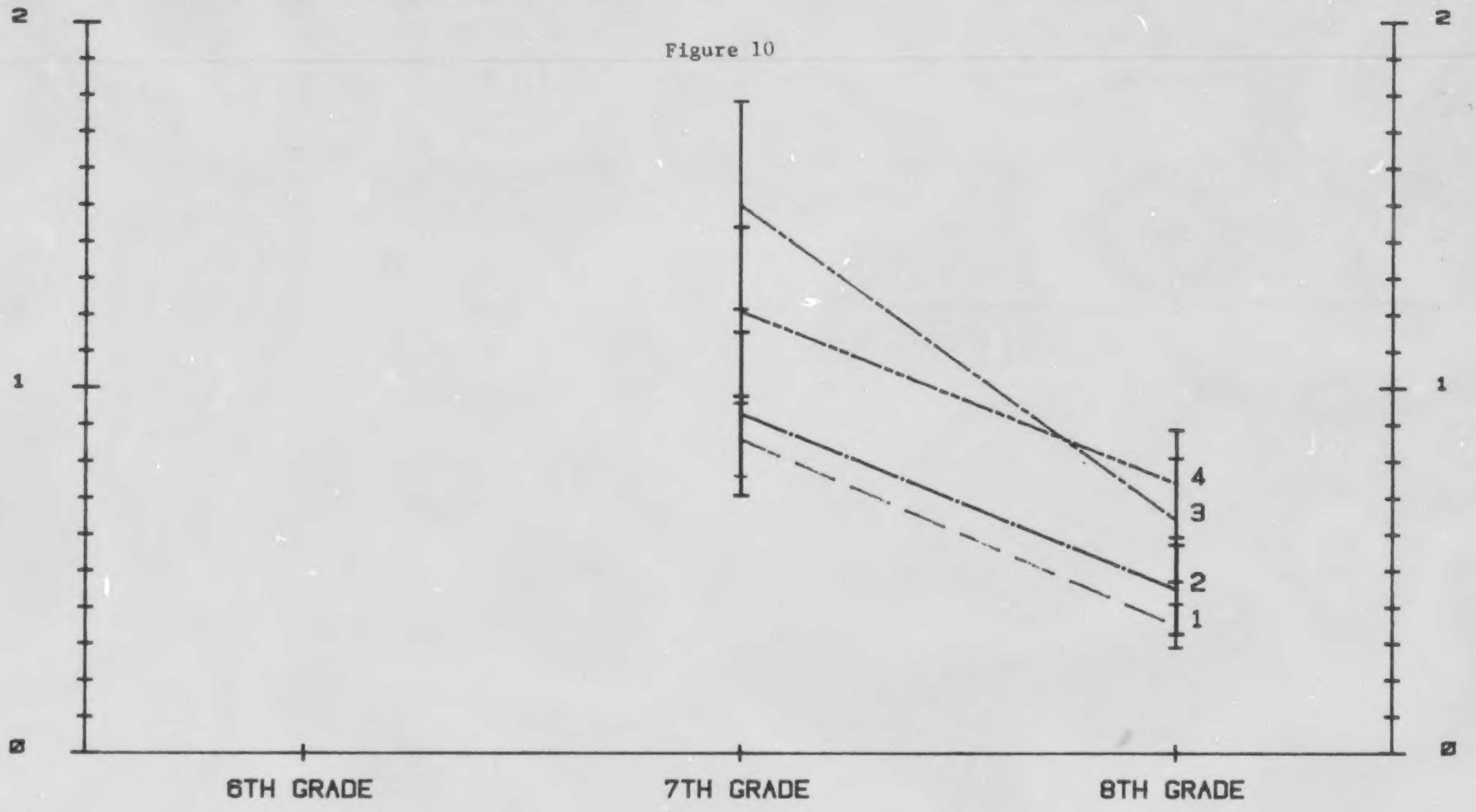


Figure 10

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — — —	FEMALE HIGH CONF	*	.86	.35
2	——·——·——	FEMALE LOW CONF	*	.93	.45
3	—·—·—·—	MALE HIGH CONF	*	1.50	.64
4	—··—··—·	MALE LOW CONF	*	1.21	.74

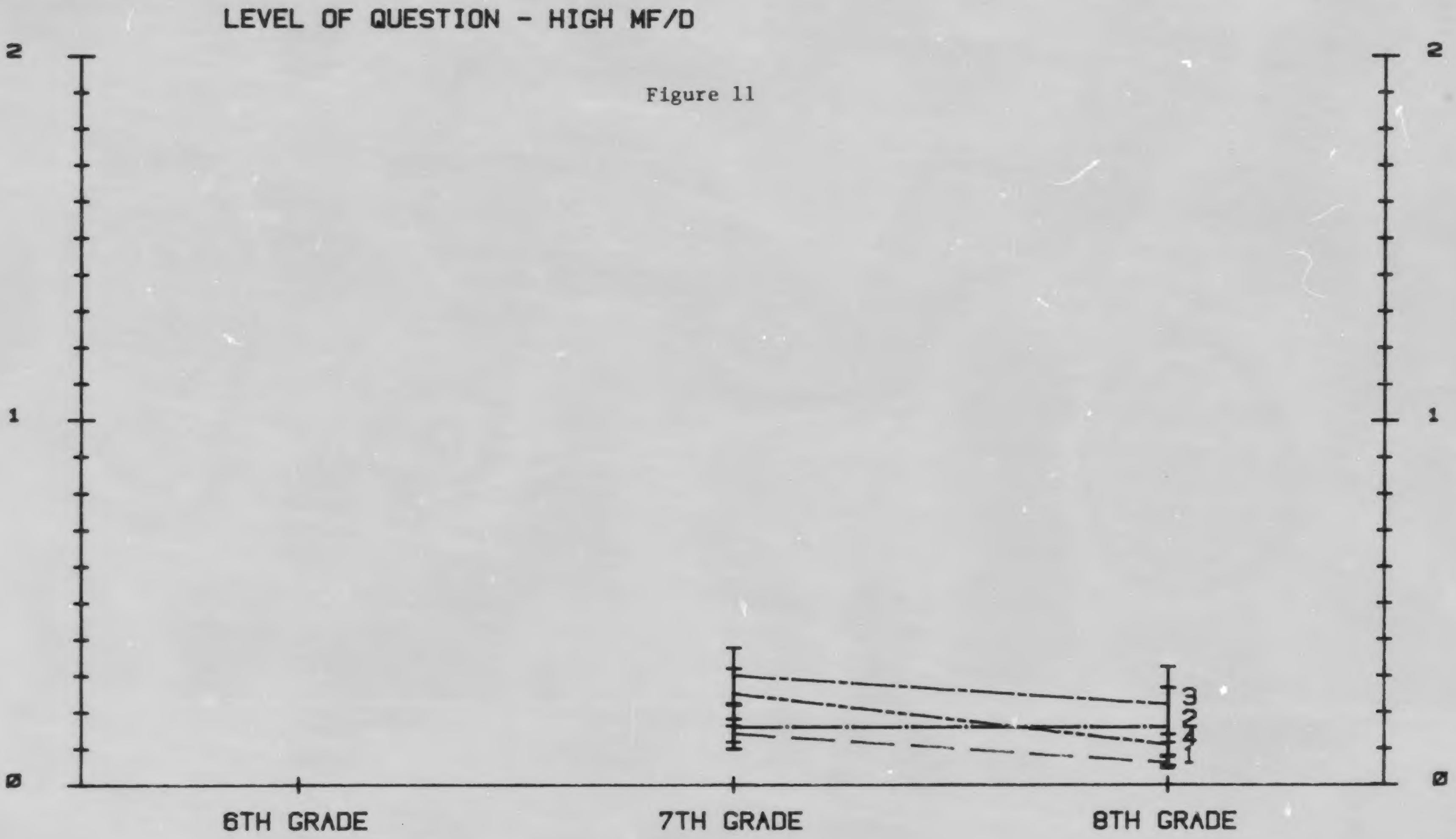


Figure 11

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.14	.06
2	—·—·—	FEMALE LOW CONF	*	.16	.16
3	—··—··—	MALE HIGH CONF	*	.30	.22
4	-·-·-·-·-	MALE LOW CONF	*	.25	.11

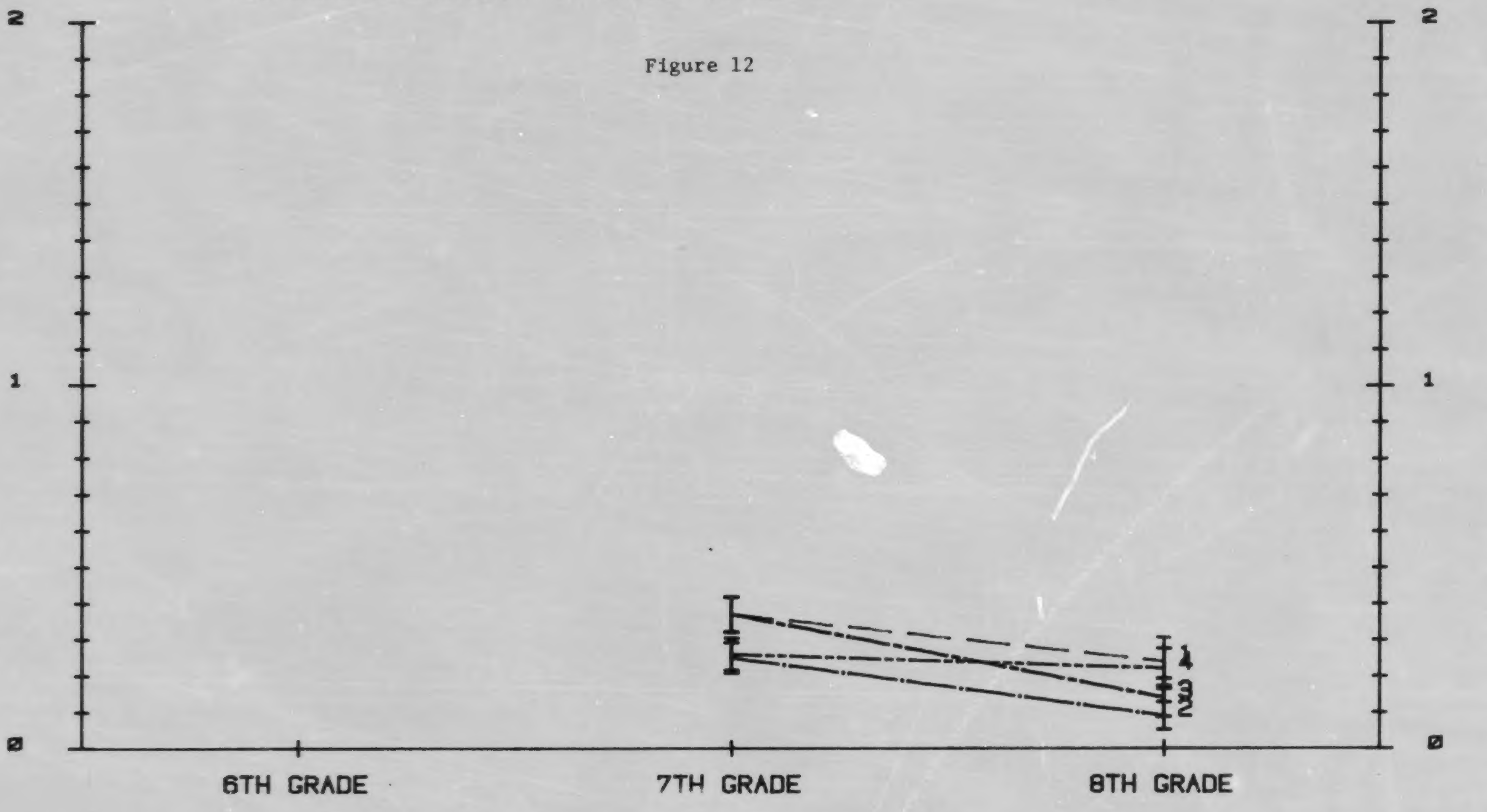
Teachers do tend to directly call on High Confidence Level Girls slightly more than other groups and Low Confidence Girls less than other groups (Figure 12). Teachers initiated contacts with boys more than girls for discipline reasons (Figure 13). Teachers also called on boys more when they had their hands up to respond to a question (Figure 14). Teachers responded to call outs by boys more often than they did to girls (Figure 15). These latter two may have been due to the boys' behavior more than to the teachers, however, with boys calling out and raising their hands in response to a question more than did girls.

It appears clear from inspecting these two year plots and the results of the ANOVAs that teachers are not only interacting significantly more with boys, but are also initiating more interactions with boys than with girls. While girls are receiving more equitable treatment privately than they do publically, overall girls are receiving less attention from teachers than are boys. Teachers do seem to be adjusting their behavior to the confidence level of girls to some extent. While they do not interact publically with low confidence girls as much as with other groups (Figure 5) and initiate the fewest public interactions with this group (Figure 7), the days with no private interactions (Figure 6) and the private interactions initiated by the teacher (Figure 8) show few differences by group.

Understanding how a teacher responds to children is almost impossible with these data because the number of times a teacher gives feedback is related to the number of interactions that occur. While boys received more positive, neutral, sustaining and negative feedback than did girls, they also participated in more interactions that required feedback. (See Appendix E for these plots.)

RESPONSE OPPORTUNITY - DIRECT MF/D

Figure 12



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.37	.24
2	——·——	FEMALE LOW CONF	*	.25	.09
3	—·—·—	MALE HIGH CONF	*	.37	.14
4	-·-·-·-	MALE LOW CONF	*	.26	.22

TEACHER INITIATED BEHAVIORAL - CRITICISM MF/D

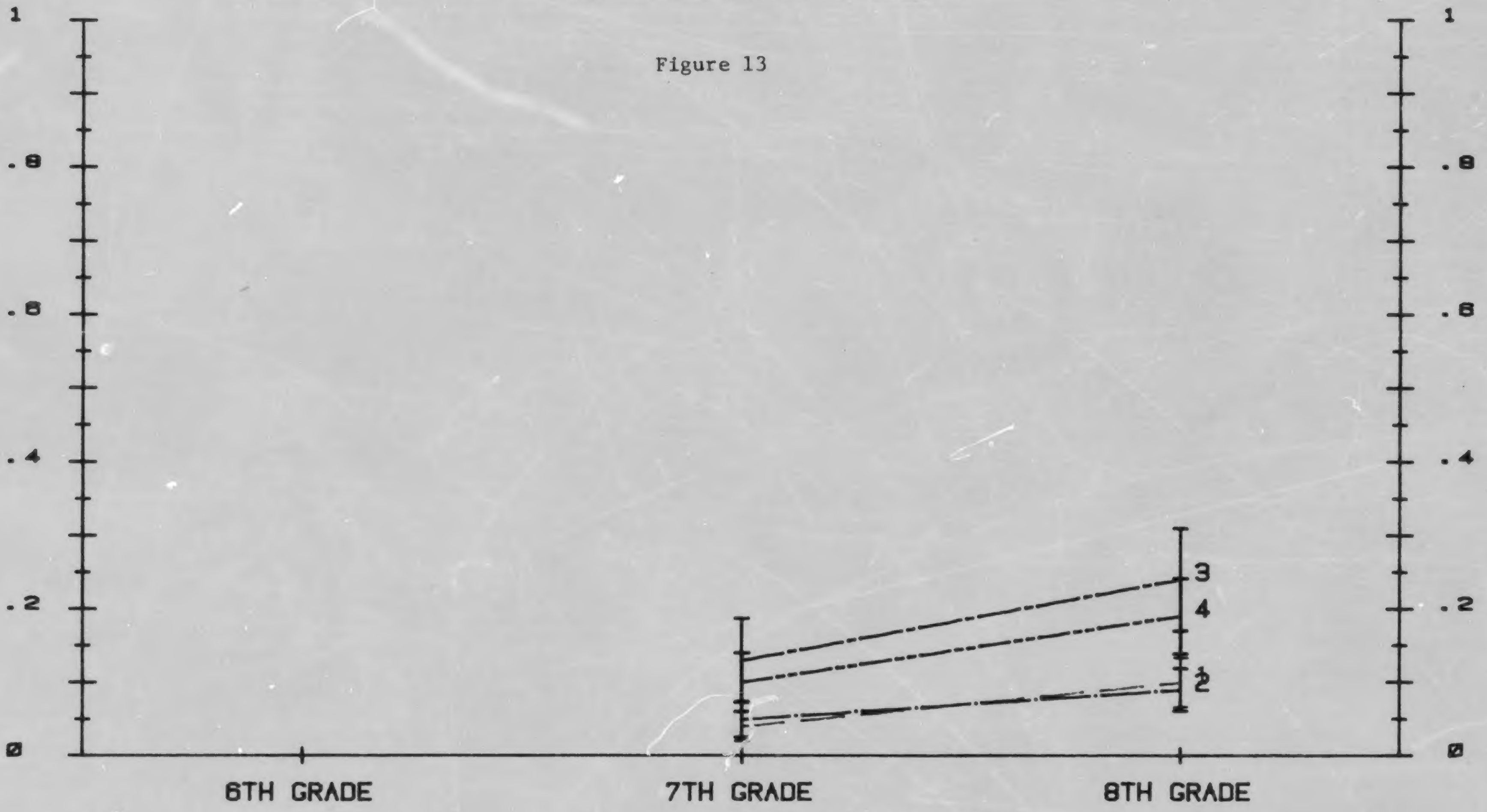
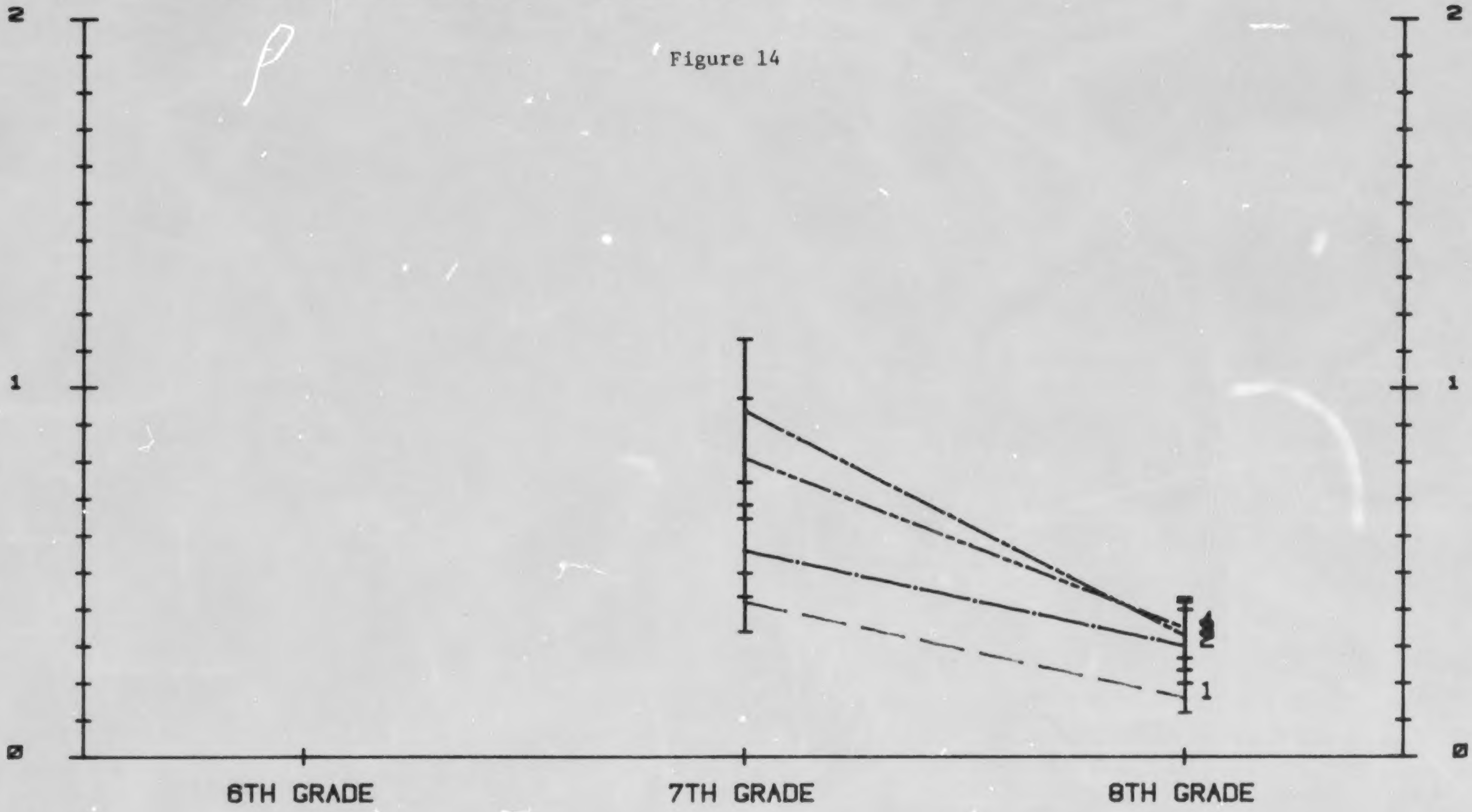


Figure 13

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — — —	FEMALE HIGH CONF	*	.04	.10
2	——·——	FEMALE LOW CONF	*	.05	.09
3	——·——·——	MALE HIGH CONF	*	.13	.24
4	———·—·—	MALE LOW CONF	*	.10	.19

RESPONSE OPPORTUNITY - OPEN MF/D

Figure 14



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.42	.16
2	——·——	FEMALE LOW CONF	*	.56	.30
3	——·—·——	MALE HIGH CONF	*	.94	.33
4	——·-·-·——	MALE LOW CONF	*	.81	.35

RESPONSE OPPORTUNITY - CALL OUT MF/D

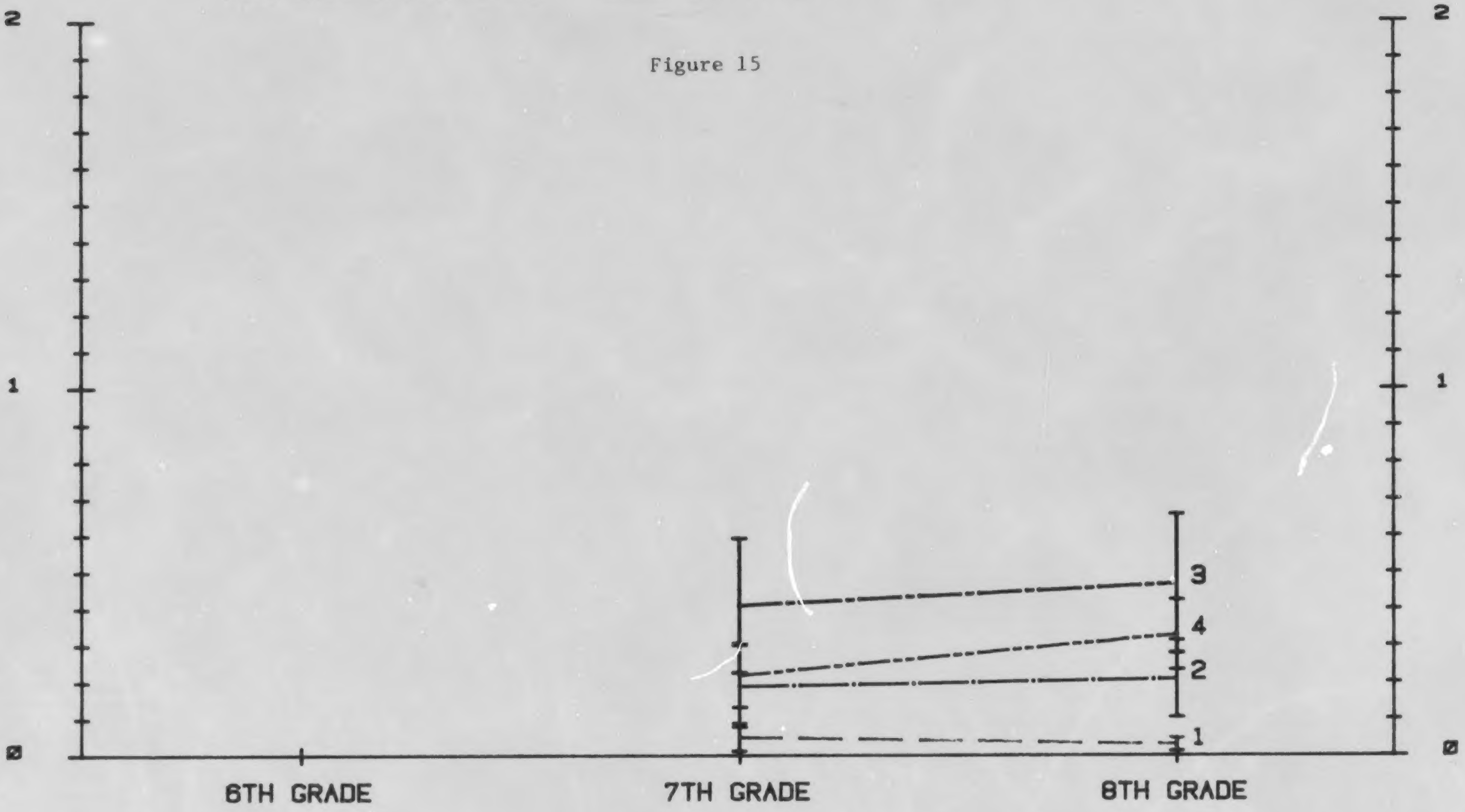


Figure 15

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.05	.03
2	——-——-——	FEMALE LOW CONF	*	.19	.21
3	——--——--——	MALE HIGH CONF	*	.41	.47
4	----------	MALE LOW CONF	*	.22	.33

PUBLIC INITIATED BY STUDENT MF/D

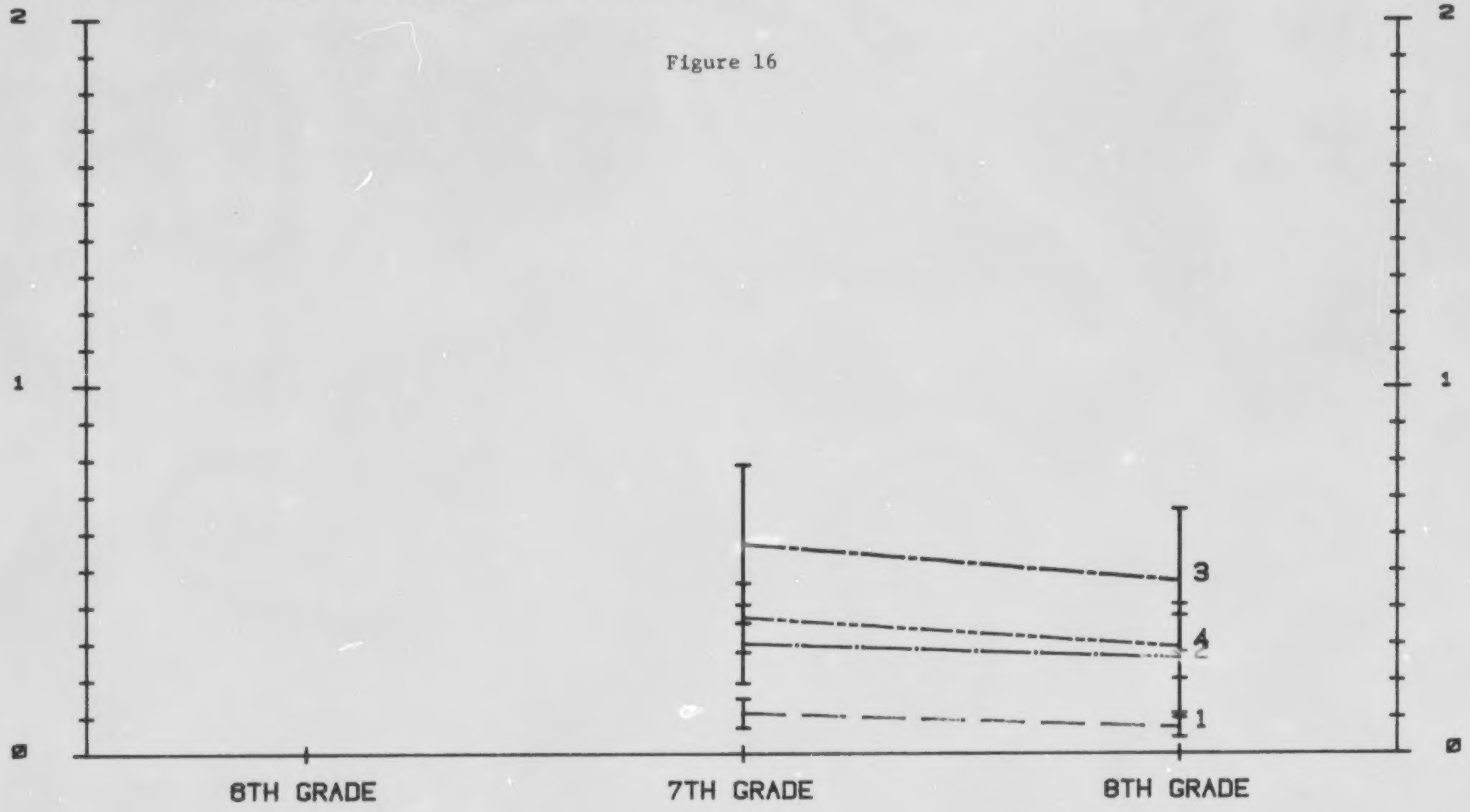


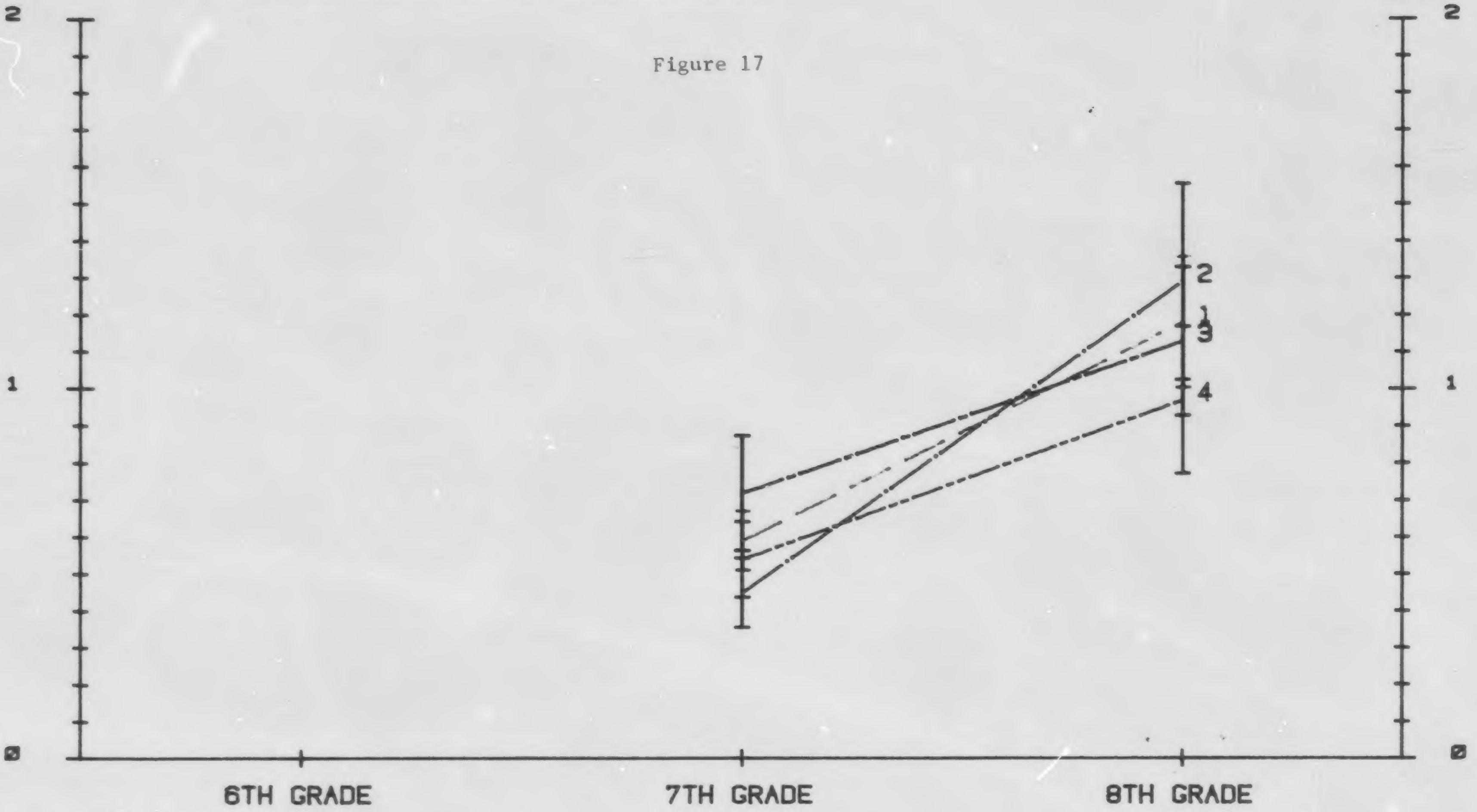
Figure 16

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — — —	FEMALE HIGH CONF	*	.11	.07
2	—·—·—	FEMALE LOW CONF	*	.30	.26
3	—-—-—	MALE HIGH CONF	*	.57	.47
4	-·-·-·-·-	MALE LOW CONF	*	.37	.29

HEWLETT PACKARD

PRIVATE INITIATED BY STUDENT MF/D

Figure 17

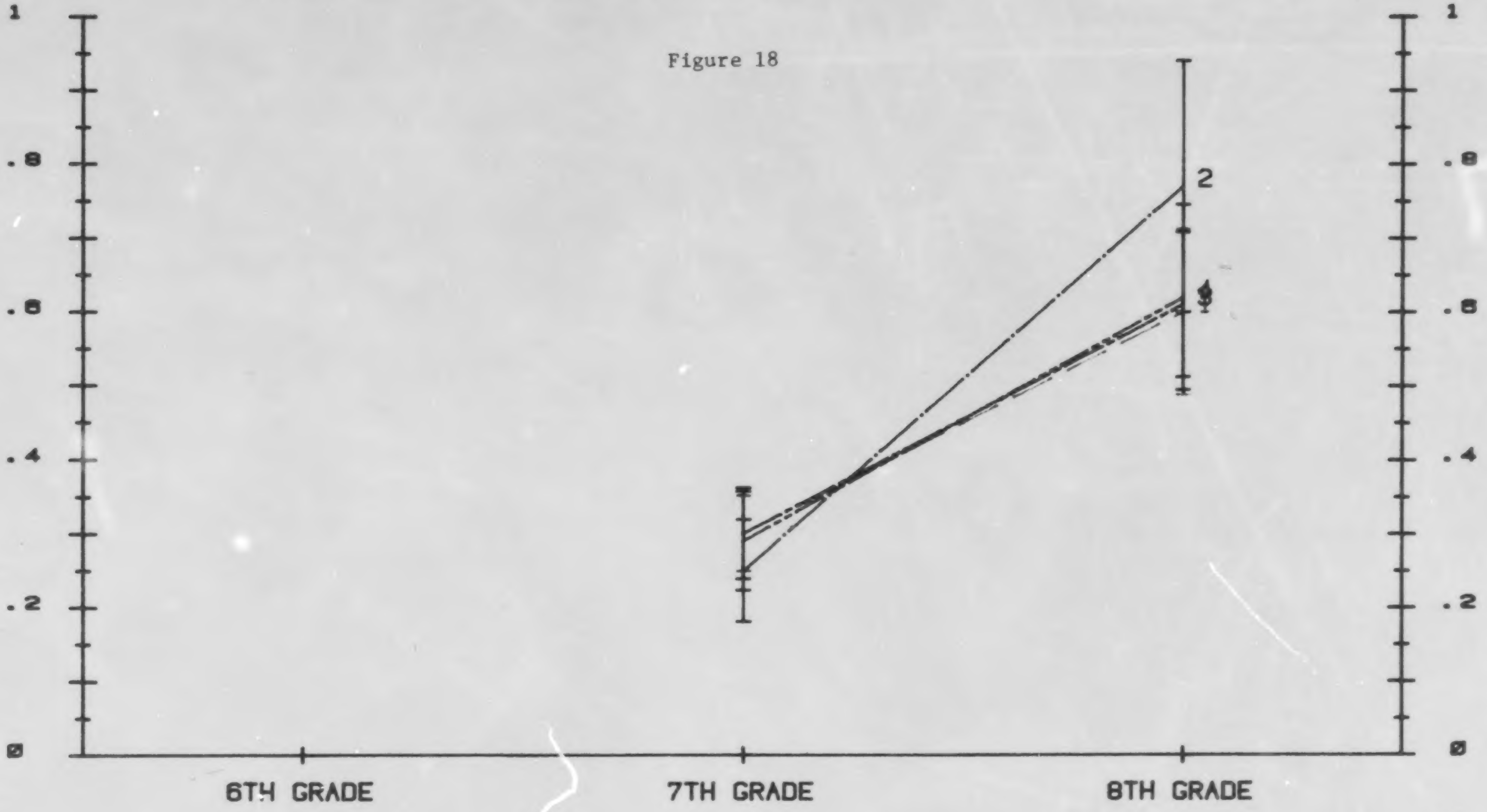


#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — — —	FEMALE HIGH CONF	*	.59	1.18
2	—·—·—	FEMALE LOW CONF	*	.45	1.29
3	——·——·——	MALE HIGH CONF	*	.72	1.13
4	-·-·-·-·-	MALE LOW CONF	*	.54	.97

HEWLETT PACKARD

STUDENT INITIATED WORK - LOW LEVEL MF/D

Figure 18



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — — —	FEMALE HIGH CONF	*	.30	.60
2	——·——·——	FEMALE LOW CONF	*	.25	.77
3	—·—·—·—	MALE HIGH CONF	*	.30	.61
4	-·-·-·-·-	MALE LOW CONF	*	.29	.62

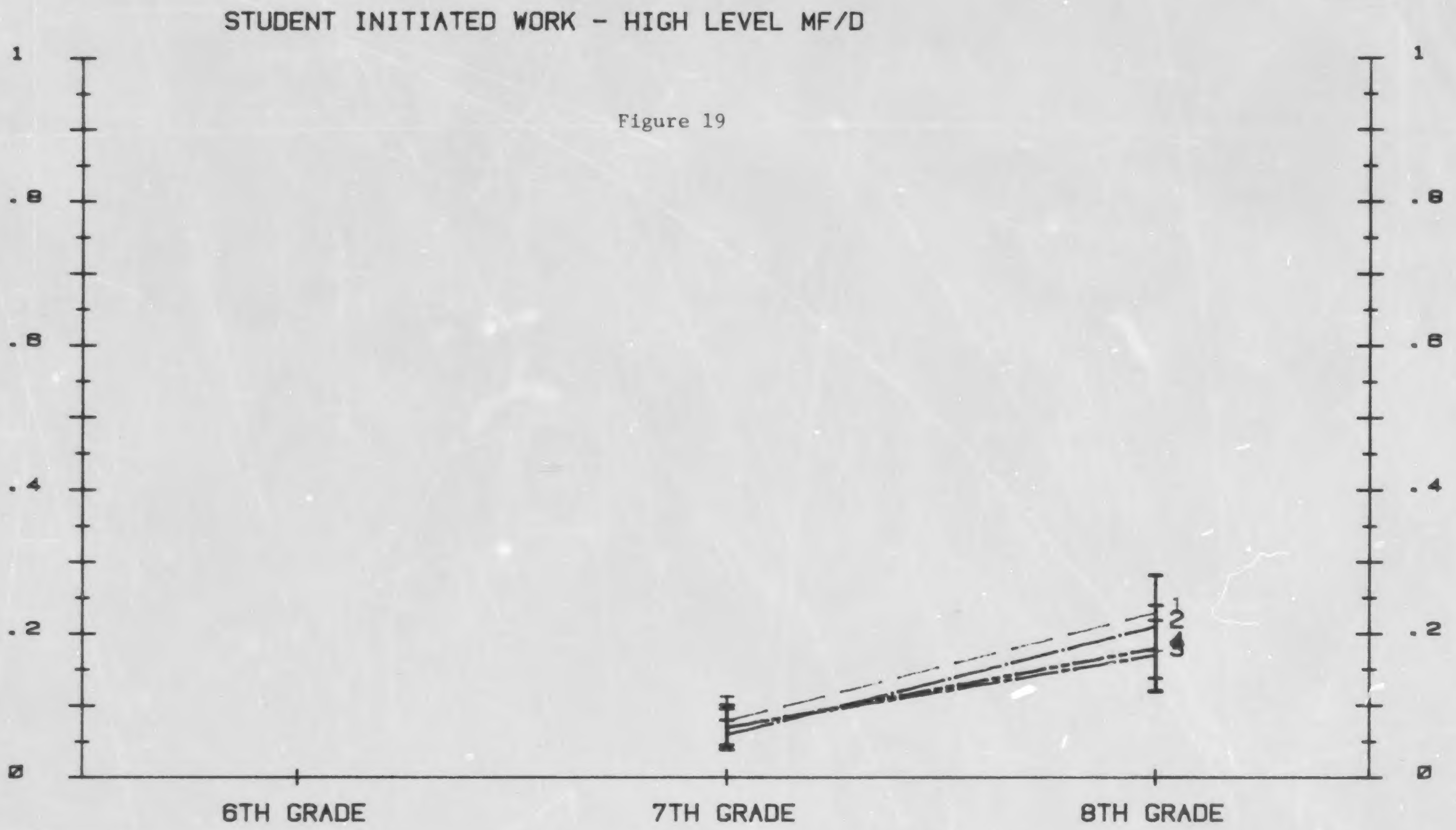


Figure 19

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	-·- — - -	FEMALE HIGH CONF	*	.08	.23
2	—·—	FEMALE LOW CONF	*	.06	.21
3	—·-·—	MALE HIGH CONF	*	.07	.17
4	-·-·-·-	MALE LOW CONF	*	.07	.18

Table 10

Means and Standard Deviations of Percent of Time Engaged by Sex, Confidence Level, and Year*

Category	Year I				Year II			
	Girls		Boys		Girls		Boys	
	High x(sd)	Low x(sd)	High x(sd)	Low x(sd)	High x(sd)	Low x(sd)	High x(sd)	Low x(sd)
Engaged	66.60	64.13	66.40	59.43	67.06	66.91	68.57	65.14
	(8.34)	(8.21)	(7.94)	(10.54)	(9.12)	(6.67)	(6.59)	(9.43)
High Level	22.55	21.38	18.24	19.98	20.09	17.12	21.23	18.56
	(16.67)	(14.02)	(12.30)	(13.51)	(9.79)	(5.93)	(6.39)	(8.04)
Spatial	14.25	25.88	21.97	19.93	31.01	47.46	34.87	46.83
	(13.47)	(15.78)	(17.62)	(18.36)	(26.73)	(22.17)	(28.94)	(24.64)
Peer	3.68	4.89	3.04	4.69	8.98	8.96	5.06	5.65
	(2.98)	(6.02)	(3.16)	(4.32)	(9.83)	(12.17)	(3.56)	(5.48)

n = 20 in each group: High confidence girls, low confidence girls, low confidence boys

n = 22: High confidence boys

Table 11

F-ratios and Probability Levels from ANOVAs: Sex, Confidence Level, and Year for Engaged Time Categories*

Category	Sex	p	Confidence	p	Year	p	SxC	p	SxY	p	SxCxY	p
Engaged	.74	.39	4.72	.03*	6.33	.01	1.68	.20	1.11	.30	.08	.78
High Level	.20	.66	.52	.47	.51	.48	.21	.65	1.32	.25	.13	.72
Spatial	.08	.77	4.79	.03*	94.39	.00	1.09	.30	.03	.86	1.30	.26
Peer	3.55	.06	.64	.43	9.40	.00	.06	.81	2.50	.12	.00	.97

*df = 1,78

Student Behaviors

There is evidence that boys initiate more public interactions than do girls (Figure 16). However, an interesting finding is that while high confidence boys initiate more interactions than any other group, high confidence girls initiate the fewest. Figure 17 indicates that all girls initiated more private interactions in the 8th grade than in the 7th, so by 8th grade girls appeared to be demanding more teacher time. The low confidence girls, however, appear to be demanding more teacher time in low level interactions (Figure 18). Very few differences were found between groups in the number of high level interactions initiated by students (Figure 19).

Engaged Time

The data sheets marked by observers were checked carefully before being read by the optical scanner at Wisconsin Testing and Evaluation. Data were placed on a preliminary computer tape. Upon examination of the listing of the data, certain small errors were found, such as omission of observer or teacher identification numbers, and date of observation. These errors were easily corrected. After correcting the errors, Wisconsin Testing and Evaluation produced the complete data tape.

The data on tape were then reorganized so that for each student, each variable from each cycle was recorded separately. A daily percent was calculated for each student for each day for each variable. Each student's daily percents were then summed and divided by the number of days that student was observed to form a mean percent per day. The variables thus formed were: (a) mean percent of cycles engaged in mathematics (Engaged Cycles) and (b) mean percent of cycles engaged in mathematics where subject

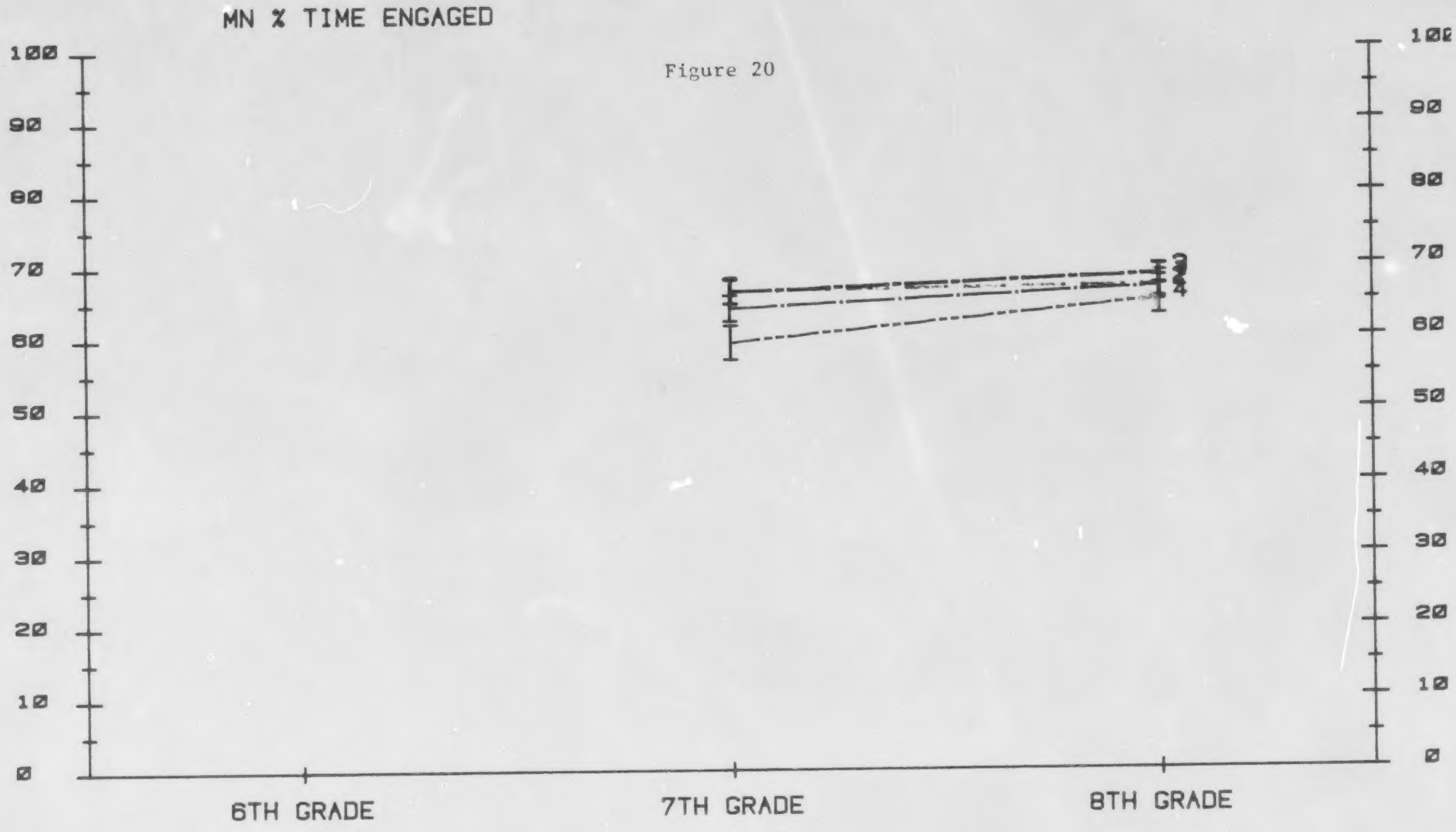


Figure 20

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	—· —·· —· —	FEMALE HIGH CONF	*	66.60	67.06
2	——·——·——	FEMALE LOW CONF	*	64.13	66.91
3	—— — ——	**MALE HIGH CONF**	*	**66.40**	**68.57**
4	- - - - - - -	MALE LOW CONF	*	59.43	65.14

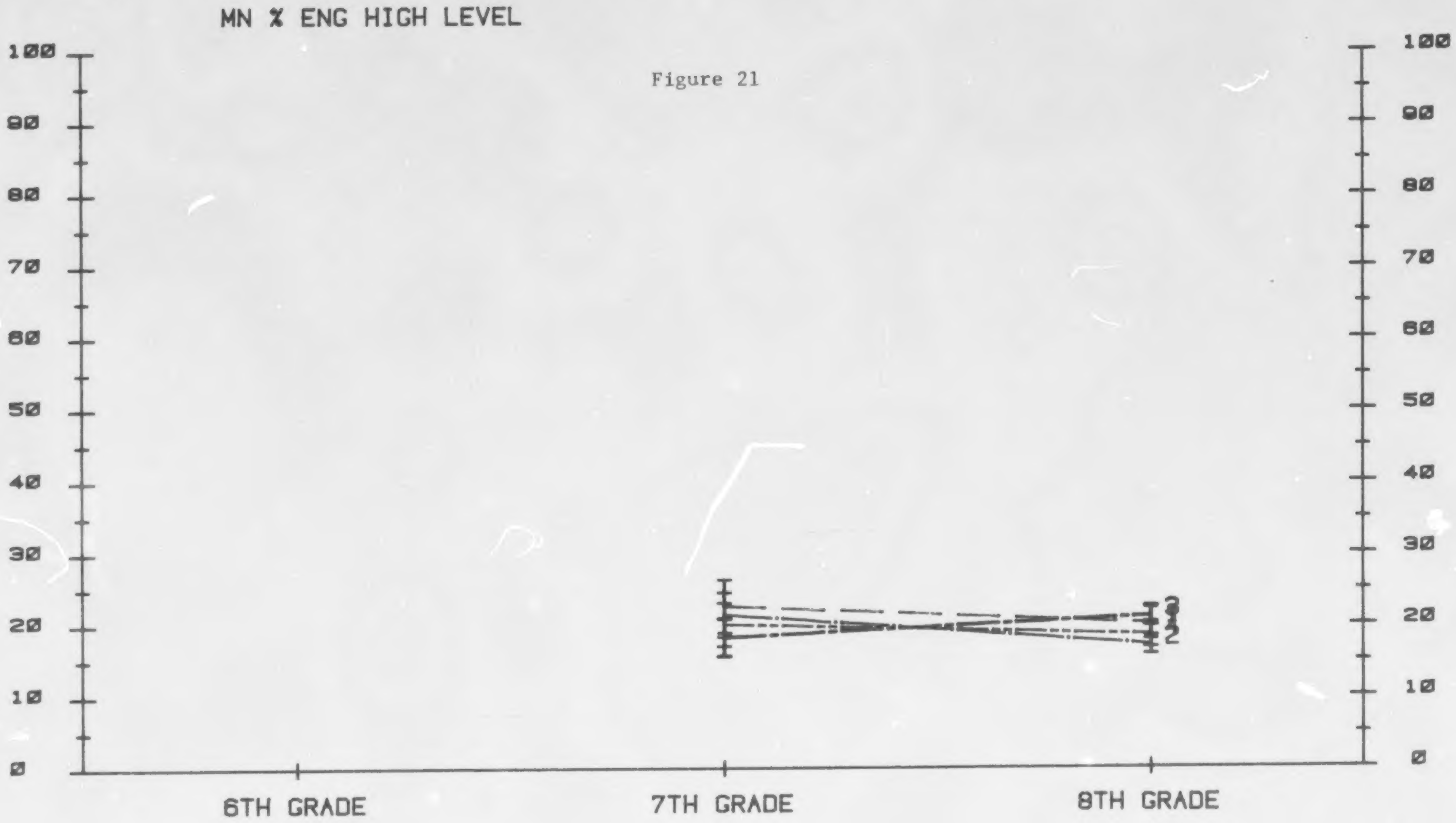


Figure 21

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	22.55	20.09
2	——·——·——	FEMALE LOW CONF	*	21.38	17.12
3	———·———	MALE HIGH CONF	*	18.24	21.23
4	----·----	MALE LOW CONF	*	19.98	18.56

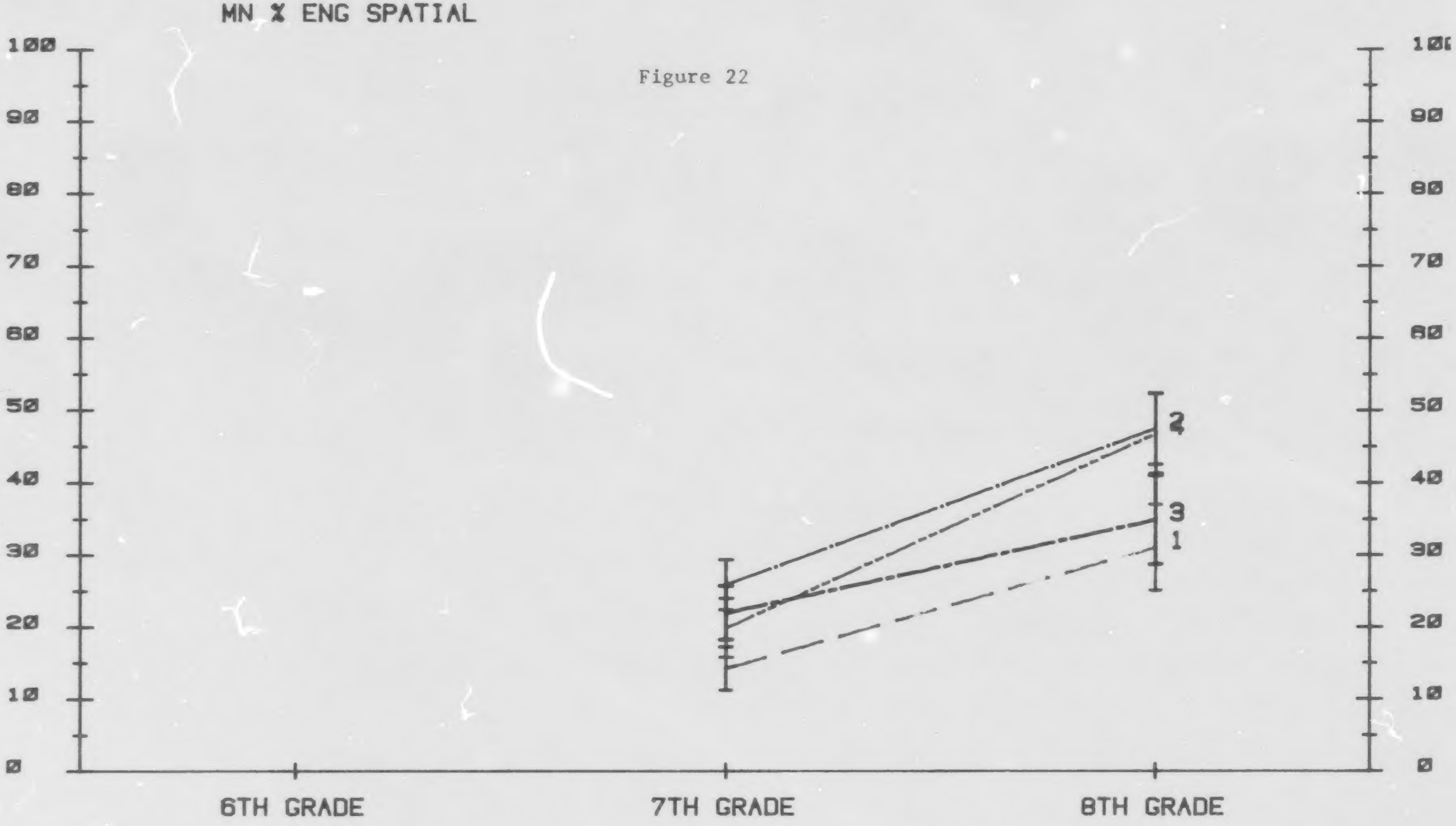
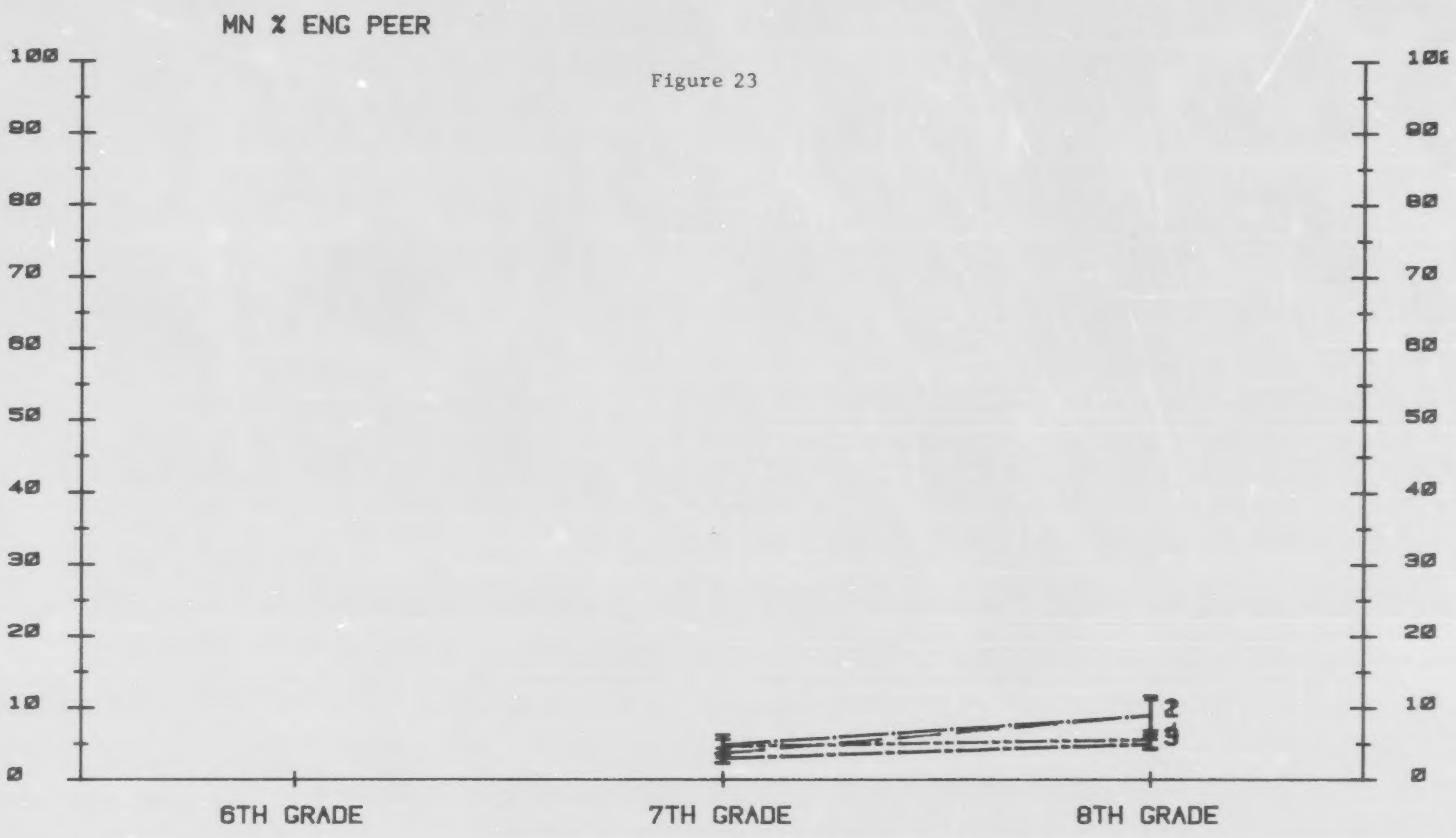


Figure 22

#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	14.25	31.01
2	—·—·—	FEMALE LOW CONF	*	25.88	47.46
3	—·-·—	MALE HIGH CONF	*	21.97	34.87
4	-·-·-·-	MALE LOW CONF	*	19.93	46.83

Figure 23



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — — —	FEMALE HIGH CONF	*	3.68	8.98
2	—·—·—	FEMALE LOW CONF	*	4.89	8.96
3	—··—··—	MALE HIGH CONF	*	3.04	5.06
4	—···—···—	MALE LOW CONF	*	4.69	5.65

83

92

was working on a higher cognitive level task (Higher Level Cycles). For these variables, the mean percent per day values for students were summed within group and then divided by the number of students in the group to form group means. These means and standard deviations are in Table 10 and F ratios found from ANOVAs computed with them are in Table 11. The plots of the various categories of Engaged Time are shown in Figures 20-23. No significant sex differences were found although girls were engaged more with peers than were boys (p=.06). Low confidence students were engaged significantly more in spatial activities than were high confidence students.

Conclusions and Discussion

Three major questions were addressed in this study and each will be discussed separately.

1. Are there sex-related differences in participation in selected classroom processes?

The answer to this question is yes. Boys in the 7th and 8th grades do participate in more teacher/student interaction than do girls. Teachers initiate more interactions with boys than with girls, discipline boys more and ask boys more questions. Boys also initiate more interactions with teachers than do girls. Most of these sex-related differences appear in Public interactions, i.e., when the teacher is interacting in a group session.

Boys and girls are not engaged in different activities during mathematics classes, however. They were working on mathematics about the same percentage of time, and they were working with high level and spatial tasks about the same percentage of time.

2. Do girls and boys of different confidence levels participate differently in classroom processes?

The answer to this question is sometimes. Both girls and boys of low confidence levels engage in more spatial activities. High confidence boys participate in more interactions than any other group while high confidence girls participate particularly in public interactions less than any other group. These high confidence girls--more than any other group--don't interact with the teacher at all on many days.

It is in the public interactions where the largest differences are found. There are fewer teacher/girl than teacher/boy interactions. Why is this? This study doesn't tell us why but some speculations are in order. Keep in mind the age of these students at the beginning of adolescence and the fact that they are above the means of their group in mathematics achievement. Did those girls hesitate to initiate interactions because they are becoming increasingly concerned with their sex identity and feel that they were less feminine if they appeared in their peers' eyes to be succeeding in mathematics? Were the teachers also indicating a belief that mathematics was more important to boys than to girls?

3. Does the participation in classroom processes change over time?

The answer to this is--in some cases yes--and in some cases no. While overall sex differences emerged both years, no consistent trend could be found.

One other major conclusion must be drawn from this study. While the sex differences found were pervasive - cutting across 19 classrooms and 2 years of study, they were also not as dramatic as the literature would lead one to believe. The differences found were subtle, found only after three or more weeks of observation and in many cases differences were not found at all. The problem of causation of sex-related differences in mathematics is not easily identified. Blatant sexism did not exist, except very occasionally, in the classrooms. Too much rhetoric and literature overgeneralizes results that are found. We must cease doing this.

Several avenues of promise for future investigation emerged from this study. Differences between high and low confidence girls and boys should be explored further.

An in depth study of differences between high and low confidence girls might give specific direction for interventions. Would high confidence girls profit from assertiveness training that would permit them to receive equitable treatment from teachers? Would low confidence girls profit more from interventions of a different type?

The relationship found between participation in spatial activities and low confidence learners needs further exploration. Are these low confidence girls and boys becoming too dependent on such activities and not relying on activities of a more abstract nature? Does this inhibit learning in mathematics?

Future studies of sex-related differences in classroom processes should utilize other processes than the ones observed in this study. Perhaps more dramatic differences will be found that will further contribute to our knowledge of sex-related differences in mathematics.

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Appendix A

Observer's Manual

Teacher-Student Interaction

Year I

Final Draft

February 18, 1979

OBSERVER'S MANUAL
TEACHER-STUDENT INTERACTION

by

Laurie Reyes

Elizabeth Fennema

Revised November 1979

Table of Contents

PREFACE. iii

PART I - Continuous Observation. 1

Introduction. 1

Response Opportunities. 3

Discipline Questions 5
Direct Questions 6
Open Questions 7
Call Outs. 8

Level of Question 10

Process Questions. 10
Product Questions. 11
Non-Mathematics Questions. 12

Student's Answer. 14

Correct Answers. 15
Part-Correct Answers 15
Incorrect Answers. 16
No Response. 16

Teacher's Feedback. 16

Positive Feedback. 18
Neutral Feedback 19
Negative Feedback. 19
Sustaining Feedback. 19

Non-Public Teacher-Student Interactions 23

Work-Related Contacts. 24
Student-Created. 24
Teacher-Afforded 24

Procedural Contacts. 27
Student-Created. 27
Teacher-Afforded 27

Behavioral Contacts. 29
Praise 30
Warning or Criticism 31

Teacher Comments. 32

General Coding Conventions: Validity 32

PART II - Time-Sampled Observation 38

Observation Procedures. 38

General Procedures. 39

Target Student Recognition 39
Avoiding Communication with Students 40
Sampling Moments 41
Investigating the Moment Sampled 42
Attending to Non-Target Students 42

Time-Sampled Observation Categories 43

Attendance 43
Student Engagement 43
Level of Engagement. 45
Spatial Engagement 46
Peer Interaction 46
Teacher and Student Location 46

Appendix One 48

Checklist-Continuous Observation. 48
Checklist-Time-Sampled Observation. 52

Appendix Two 53

Sample Coding Sheet-Teacher-Student Interaction 54
Sample Coding Sheet-Engaged Time. 55

Appendix Three - Teacher Comments. 56

PREFACE

A middle school mathematics classroom contains many different types of students engaged in a variety of activities. The purpose of this study is to find how students with certain characteristics vary in the activities they engage in and in the quantity and quality of their interactions with mathematics teachers. This will be done by observing a number of middle school students in their mathematics classes as they progress through grades six, seven and eight.

Due to the complexity of the classroom two different types of observation are to be done simultaneously by two observers. An individual observer does only one type of observation at a time. One observer focuses on the interaction between the teacher and a few students in the class (target students). This observer codes certain teacher and student behaviors continuously. Another observer focuses on the types of activities the target students engage in and the way target students interact with their peers. This second observer does not code continuously, but rotates from one target student to another each 30 seconds. Each observer records his/her observations on a specially designed coding form.

This manual is designed to be used in two ways. It is designed to aid in the training of observers. It is also to be used as a reference during the actual classroom observations.

The manual is written in two parts. Part I contains descriptions of the categories of teacher-student interaction to be coded in the continuous observation. Instructions for recording the observed behaviors on the coding form are also in Part I. Part II of this manual gives descriptions of the behaviors to be coded in the time-sampled observation (i.e., observation rotates periodically from one target student to another) and gives instructions for using the time-sampled observation coding form.

Outlines of the observation categories for the continuous coding and the time-sampled coding are provided. These and the coders checklists provide a quick reference for observers in the classroom. Before each observation, the observer should review the description of each category and the distinctions between the different categories. After each observation, the coder is responsible for going over the appropriate checklist to ensure that the coding form has been completed fully and accurately.

PART I

INTRODUCTION

This part of the manual presents the coding system used to study teacher-student interactions in classrooms. This system is only a slight modification of a coding system developed by Jere E. Brophy and Thomas L. Good to record the classroom dyadic interaction between teachers and students. (In fact, large portions of this observer's manual were taken directly from the Brophy-Good manual with permission. Those sections of Part I which are taken from the Brophy-Good manual are printed in italics.) Emphasis is placed on the word dyadic, since this system focuses on classroom interactions in which the teacher is dealing with a single student.

This system does not involve coding everything that goes on in the classroom. It does, however, attempt to code every interaction that goes on between the teacher and individual target students. *In addition, several aspects of the system involve preservation of the sequential nature of teacher-student interaction, so that cycles of initiation and reaction are not lost in the coding process. This feature is especially important for studying the communication of performance expectations, since it allows separation of effects due primarily to the teacher from effects due primarily to the student. The system also allows for the conversion of raw codes from the individual students into percentage scores which neutralize the effects of differences in the absolute frequencies of various types of interactions they have with their teacher. Teachers' interactions with particular students or subgroups of students may then be compared directly with interaction in equivalent situations with other individuals or groups. In this way, quality of contact (what the teacher does when engaged in certain kinds of interactions with the student) and quantity of contact (the sheer frequency of the different* *kinds of interactions) may be studied separately and evaluated.*

General Overview

Four different types of dyadic interaction situations will be coded in this study. In addition, certain comments by teachers will be coded.

The types of dyadic interactions are:

1. Response Opportunities, in which the student publicly attempts to answer a question presented by the teacher. The type of question, its cognitive level, the student response to the question and teacher feedback to the student response are all recorded to maintain the sequence of their occurence.

2. *Procedural Contacts, in which the teacher-student interaction concerns permission, supplies and equipment or other procedural matters concerned with the student's individual needs or with classroom management.*

3. *Work-Related Contacts, in which the teacher-student interaction concerns seat work, homework, or other written work completed by the student.*

4. *Behavioral Contacts, in which the teacher disciplines the student or makes individual comments concerning the student's classroom behavior.*

The teacher comment category is not considered an interaction type, but it will be coded with the interactions. Thus this category will be described following the four types of dyadic interactions.

The five broad categories of teacher and student behaviors are kept distinct from one another in coding and each type has its own place for coding on the coding sheet. In addition to this physical separation, coding distinctions are also made concerning the nature and sequence of the interaction observed. For every interaction, coders note whether the initiator was the teacher or the student and also code information concerning the teacher's message or response to the student during the interactions. The coding of response opportunities also includes information concerning the type of question asked and the quality of the student's response, both of which are coded before coding the nature of the teacher's feedback. The latter coding also includes preservation of the sequential order of events, so that the chain of action and reaction sequences within these interactions is maintained.

RESPONSE OPPORTUNITIES

The coding of response opportunities is perhaps the most difficult coding in the system, since several aspects of the interaction have to be coded and the sequence of events within the interactions must be maintained and indicated in the coding. To some extent, the sequential aspects have already been designed into the coding sheet, since in going from left to right, the coder takes up coding decisions in the order in which they tend to occur naturally: first, the observer indicates the 1-digit number of the student and the type of response opportunity; then the observer codes the level of question; then she/he codes the quality of the student's answer; then, she/he codes the teacher's feedback to the student's answer. Each of these aspects of coding response opportunities is described in turn below, after clarification concerning the term "response opportunity."

Three key aspects characterize "response opportunities" as they are defined in this system: (a) they are *public* interactions between the teacher and only a single student at a time, but nevertheless meant for and monitored by the entire class or by the entire group operating at the moment; (b) they occur *when the teacher asks a question* demanding a verbal response from the student, when she asks the student to *publicly* respond to a question requiring a non-verbal response (such as indicating something on the board, pointing to the right letter or work, etc.), or *when a target student* initiates a public interaction; (c) only a *single individual student* makes the response (chorus or unison responses in which two or more students call out the answer *simultaneously are not considered "response opportunities"). Thus, a response opportunity involves a public interaction between an individual student and the teacher.*

Response opportunities thus, involve individual recognition of the student by the teacher. The previously mentioned situation in which two or more students call out an answer simultaneously is not considered a "response opportunity" because no individual student receives individual recognition or feedback. Even if only a single student calls out the answer, a response opportunity is coded only if the teacher responds to him/her in some way. Should the teacher ignore his/her answer altogether, it is not considered a response opportunity.

The public nature of the "response opportunity" distinguishes it from the various forms of teacher-afforded and student-created non-public contact (procedural, work-related, and behavioral). In the teacher-afforded and student-created work-related contacts, the teacher talks to the student about his own individual seat work. Teacher feedback here is "private," meant only for the student involved and not for the class as a whole. These contacts occur when individual students bring their work to the teacher to ask him about it or when the teacher goes around the room correcting work individually at each desk. It frequently happens that the teacher will question a student when dealing with him individually about his seat work. Such an event is coded under work-related non-public contacts and is not considered a "response opportunity," since the question is meant only for the particular student involved and is not a public question.

Information is entered on the coding sheets by coloring in circles in the appropriate columns and rows. An interaction is generally coded by coloring in circles in a single row. First, the identity of the target student is noted by filling in his/her one-digit number. Each target student in a class will be identified by a one-digit number. All interactions involving a parti-

cular target student will be noted with the same number. Each public interaction requires the coding of several bits of information. Teacher-initiated public interactions require the coding of: identity of student, type of response opportunity, level of question asked, correctness of the student's answer, and the nature of the teacher's feedback. Student-initiated public interactions require the coding of: the student's identity, type of response opportunity, level of question, and teacher feedback.

Five types of response opportunities are to be used: student-initiated, discipline questions, direct questions, open questions, and call outs. These will be defined below.

Student-Initiated

This is the only type of response opportunity which designates a public interaction initiated by a target student. The other four types of response opportunity are used to code public interactions initiated by the teacher. A student-initiated response opportunity is coded when a target student asks the teacher a question or volunteers a comment to the teacher. The teacher must respond to the question or comment in some way other than criticizing the target student for having asked the question or made the comment. Only if the teacher responds without criticizing the student's initiation behavior is an interaction coded.

Discipline Questions

The discipline question is a unique type of direct question in which the teacher uses the question as a control technique, calling on the target student to force him/her to pay better attention rather than merely to provide a response opportunity in the usual sense. In coding a discipline question, the coder should be convinced that the teacher deliberately called on the *student involved because of poor attention or cooperation. Usually this will involve direct evidence in the teacher's subsequent behavior, as when he responds to the student's inability to answer with a statement such as "Maybe if you paid better attention, you'd know the answer." Thus, discipline questions should be conservatively coded; the fact that the teacher may ask a direct question of a student who has not been completely attentive in the preceding moments does not by itself constitute enough evidence to code the discipline question. There must be some indication that the teacher has deliberately called on the child to compel his/her attention.*

Direct Questions

Except for the special case of discipline questions, all instances in which the teacher calls on a target student who is not seeking a response opportunity are coded as direct questions. Direct questions are the clearest examples of teacher-afforded response opportunities. In contrast to open questions and call outs, in the direct question, the student does not raise his hand, call out an answer, or otherwise indicate that he wants to respond. Instead, the teacher calls on him to respond without any indication if interest or willingness on his part. Thus, whenever a teacher publicly asks a question (thereby creating a response opportunity) and calls upon a target student who does not have his hand up to answer it, it is coded as a direct question. This includes instances in which the teacher calls on a target student before he has a chance to raise his hand (as when he names the student before asking the question) as well as instances in which the teacher calls on a child who does not have his hand up rather than on one who does.

Open Questions

In the open question, both the teacher and the student are involved in determining who gets the response opportunity. Here the teacher asks a question, waits for the students to raise their hands and then calls on one of the students who has his hand up. The teacher creates the response opportunity by asking a public question, and also indicates who is to respond by calling on an individual student, but he chooses one of the students who has indicated a desire to respond by raising his hand. Thus, the open question is a response opportunity which is partly teacher-afforded and partly student-created. An open question is coded when a target student volunteers to answer a teacher question and is called on to respond by the teacher.

Occasionally, there will be difficulty distinguishing between a direct question and an open question. This occurs when the teacher poses a question and waits for students to raise their hands, but calls on a target student whom the coder has not been watching. The coder must quickly check to see if the target student had his/her hand up or not. If the teacher has called on a target student with his/her hand up, the response opportunity should be coded as an open question; if he has called on a target student who did not have his/her hand up, it should be coded as a direct question. Whenever the coder is not sure whether or not the target student had his/her hand raised, the response opportunity should be coded as an open question. This means that the category of direct questions will be kept restricted to those instances in which coders are certain that the teacher called on a target student who did not seek out an opportunity to respond. The category of open questions will then include both instances in which the coder is certain that the teacher called on a target student who raised his/her hand and instances in which the coder is not certain whether or not the target student raised his/her hand.

Call Outs

Response opportunities created by target students who call out answers to teachers' questions without waiting for permission to respond are coded in the call out column. The teacher creates the response opportunity by asking a public question, but one student calls out an answer to this question before the teacher has a chance to indicate that a particular student should respond. This type of response opportunity is therefore, student-created, in that it was not the teacher's intent that the target student answer the question. Besides those already mentioned, one additional consideration must be present before coders code a response opportunity under call out: the teacher must recognize the target student's response and make some response to the student in reaction to it. Called out answers by target students which are ignored by the teacher are not considered response opportunities and are not coded. A response opportunity coded as call out then, requires the following: (a) the teacher asks a public question; (b) the target student calls out an answer to the question before the teacher has a chance to call on anyone to respond; (c) the teacher then turns her attention to the student who called out the answer and says something in response to him/her. The teacher's response to the student must contain feedback regarding his/her answer to the question; the interaction is not coded as a response opportunity under call out if the teacher confines her remarks to criticism of the child for calling out the answer. It is necessary, therefore, that the teacher make some feedback response to the target student who calls out the answer.

Just as there may be confusion in distinguishing between direct questions and open questions when the coder is unsure whether or not the target student has raised his/her hand, there may also be confusion in distinguishing between open questions and call outs if the coder is unsure whether or not the teacher made some indication to the target student that he/she should answer the question. There is usually little problem when the teacher calls on the children by name, but some teachers will call on children by pointing at them or otherwise non-verbally indicating that they should make a response. Coders should be particularly alert with such teachers to pick up these less obvious cues given to children to signal their permission to respond. When the coder is not sure whether or not the teacher made such a signal, and therefore is not sure whether or not to code an open question or a call out, the interaction should be coded as a call out.

The decision rules in handling ambiguous situations regarding coding of the type of response opportunity may be summarized as follows: (a) indecision between discipline question and direct question is resolved by coding direct question; (b) indecision between open question and call out is resolved by coding call out. The discipline question implies that the teacher deliberately calls on a target student because he has seen that the student is not paying attention and wishes to compel his/her attention; the direct question implies less than this, only that the teacher deliberately provides a response opportunity to a specific student; the open question implies a deliberate provision of response opportunity to a specific child, but this decision is affected by the fact that the student is one of those with his/her hand up seeking an opportunity to respond; the call out implies nothing about the teacher's decision to provide a response opportunity since the target student calls out an answer before he has a chance to provide a response opportunity.

By following the decision rules for handling the ambiguous situations outlined above, coders will, in effect, err on the side of conservatism. This procedure helps insure the validity and interpretability of the coding from systematic differences in coders' handling of ambiguous coding situation. Decision rules guided by the same rationale will be provided for resolution of other coding difficulties in which the coder is unable to choose on the evidence between two categories. In each case, the procedure will involve resolving the difficulties by coding the category which implies less about communication of teacher expectations. Thus, whatever evidence exists in the coding for the existence of behavior correlated of teacher expectations will be conservative estimates of expectation effects.

LEVEL OF QUESTION

After noting the identity of the target student involved and the type of response opportunity, the coder now codes the level of question asked by the teacher. Level of question refers to the nature of the response demand made upon the student. Three levels are identified: process questions, product questions, and non-mathematics questions. The first two levels refer only to questions about mathematics content. The third category (non-mathematics questions) is used to code all questions that do not refer to mathematics. Such questions either deal with subject matter other than mathematics or do not have objectively verifiable, right or wrong answers. They often ask the target student for her/his opinions or reactions, or they ask about her/his personal experiences, home life, or other factors in her/his personal background. *The three levels of questions are defined as follows:*

Process Questions

This is the most complex level of question, in which the target student is required to explain something in a way that requires her/him to intergrate facts or to show knowledge of their interrelationships. It most frequently is a "why?" or "how?" question and usually requires an extended phrase or sentence for formulating an adequate response -- single word answers are not usually sufficient. A process question requires the student to specify the cognitive and/or behavioral steps that must be gone through in order to solve a problem or come up with an answer.

Product Questions

Product questions seek to elicit a single correct answer which can be expressed in a single word or a short phrase. Product questions differ from process questions in that they only require knowledge of a specific fact and do not force the target student to integrate several facts or to make inferences from them. Product questions usually begin with "what?," "when?," "where?," "how much?," or "how many?." Many of the response opportunities will be coded as product questions, as when the target student is asked to give the answer to a homework or classwork problem. While the student may have to go through many cognitive processes in order to arrive at the answer, the question itself as asked does not require her/him to verbalize these processes but only to produce the answer. So long as this is true, the question is a product question and the response demand on the target student is less than it is for a process question, since less is required of the student and since the possibility remains that she/he might guess the answer without knowing the process that the teacher wants her/him to know.

In some product questions the target student does not have to produce a substantive response but may instead simply choose one of two or more implied or expressed alternatives. Included are yes-no questions, either-or questions andquestions which present more than two alternatives but which make it clear that the correct answer is one of the alternatives presented. Occasionally, *a large number of alternatives will be present. This nevertheless, is still coded as a product question.*

Note that certain kinds of questions which might appear to be quite complex may nevertheless be coded as product questions. A question such as: "When you divide 2/3 by 3/4 is the answer larger than 2/3 or smaller than 2/3?" is coded as a product question because it is essentially an either-or question in which the respondent can take his/her choice between one of two or more alternatives. *The key factor, then, in choosing between process and product questions is not so much the content of the question itself but the level of response demand made upon the student.*

Non-Mathematics Questions

The preceding distinctions between process and product questions apply only to questions dealing with mathematics. They require the student to respond to a question concerning mathematics. The two types of questions differ from one another in the complexity of response demand made upon the students, but they have in common the fact that they apply only to mathematical subject matter. The category of non-mathematics questions includes all teacher questions which do not fit the preceding two categories because they ask the student to make some non-mathematical contribution to classroom discussion (questions about personal experiences, preferences or feelings, requests for opinions or predictions, discussion of non-mathematical subject matter such as English grammar, etc.). *Non-mathematics questions will often occur during breaks in academic routine, although they may also be asked at any time during formal lessons.* They often occur when the teacher is introducing a lesson for the day ("Have you ever gone to Chicago? How long did it take to travel to Chicago?"). Questions such as these, while relevant to the coming lesson, do not require the child to show skill or knowledge of mathematics; they merely ask her/him about her/his previous experiences.

The distinctions made previously between process and product questions within the realm of mathematics content do not apply to non-mathematics questions. That is, any question which is a non-mathematics question is simply coded as such, regardless of the apparent response demand built into the question. Most non-mathematics questions take the form of product questions and would be coded as such if they were math questions. The child is asked an either/or question or a question which is answered yes or no. Coders should be particularly alert to avoid confusing the coding of such questions. If the question deals with mathematics knowledge or skills it is coded as a product question. If it deals with personal experiences, opinions or other non-mathematical matters, it is coded as a non-mathematics question. The proper coding of level of question therefore, requires two separate coding decisions: (a) first the coder must decide whether or not it pertains to mathematics; (b) if it is a mathematical question, the coder must also decide whether it is a process or product question. The latter distinctions are not made among the non-mathematics questions, which are coded under the single label.

Confusion between mathematics questions and non-mathematics question must be resolved. Often the question as asked will be ambiguous ("What do you think would happen if ..."), and the coder will have to await the teacher's feedback to the target student's response in order to determine how she/he is going to treat the question. If the teacher is searching for a particular kind of answer and treats the target student's responses as right or wrong, the question is treated as a mathematics question. It is coded as process or product. On the other hand, if the teacher simply accepts any answer that the student gives and seems to be merely trying to get students to talk or to make a guess, the question is treated as a non-math question. In general, then, if the teacher seems to be using the question to test or teach mathematics knowledge, the question will be coded as process or product. If he/she treats the student's responses as opinions or guesses and does not evaluate them as correct or incorrect, the question is coded as non-mathematical.

STUDENT'S ANSWER

After coding the target student's identity, the type of question and the level of question, the observer codes the student's answer in one of four categories: correct, partially correct, incorrect, and no response. The teacher's reaction is taken into account in determining the correctness of the student's response. Frequently, teachers may ask ambiguous questions which are answered correctly or partially correctly from one point of view but which are treated as incorrect by the teacher, who was looking for a very specific answer. Thus, it is the teacher's perception of the correctness of the target student's response which is coded, not the coder's perception.

This distinction is important because the next variable coded is the teacher's feedback to the student's answer as perceived by the teacher. Consequently, if the teacher reacts to a response as if it is wrong, it is coded as wrong, even though another observer might consider it to be partially or even completely correct.

Correct Answers

If the target student answers the teacher's question in a way that satisfies him/her, the answer is coded as correct. Determination of whether or not the teacher is satisfied with the target student's answer does not necessarily require that the teacher positively affirm the answer or make some favorable response to it. Instead, the target student's answer should be considered correct unless the teacher makes some positive action suggesting dissatisfaction with it (explicitly explaining that the target student's answer is incorrect or only partially correct, giving the "correct" answer, or asking someone else to answer the same question). If the teacher does not make an attempt to improve upon or replace the student's answer with another, the answer is considered correct. This means that some answers that the coder would not accept but which the teacher treats as correct are to be coded as correct answers.

Part-Correct Answers

Part-correct answers are answers which are correct but incomplete as far as they go or answers which are correct from one point of view but not the answer that the teacher is looking for. Again, the teacher's feedback response may determine the way the answer is coded. If the teacher indicates that the target student's response is correct but incomplete, or if she/he indicates that the response is correct or defensible but not the answer that she/he is looking for, code the response as part-correct.

Incorrect Answers

Responses coded as *incorrect answers* are those in which the target student's response is treated as simply wrong by the teacher. The teacher need not explicitly tell the target student that she/he is wrong; he may indicate this indirectly by searching for the answer from someone else or by providing it himself. In one of these ways, the teacher indicates that the target student's answer is not an acceptable response to the question he has asked.

No Response

The preceding three types of answers (correct, part-correct and incorrect) all refer to instances in which the target student makes a substantive response to the teacher's question. All cases in which he fails to do so, either by making no response whatever or by indicating through word or gesture that he cannot answer the question, are coded as no response. The student need not make some positive action to be coded in this category; if the teacher asks him a question and waits a time for an answer but then moves on to somebody else when he does not respond, the first student is coded for *no response*. Occasionally, an ambiguous situation will arise when the target student mumbles something indistinct. If the teacher reacts in this situation as if he has understood the student to make a substantive response, the response will be coded in one of the preceding three categories. If the teacher cannot understand the target student, he is coded for *no response*.

TEACHER'S FEEDBACK REACTION

After identifying the student by number, coding the level and type of question and coding the quality of the target student's answer, the coder completes the sequence for coding response opportunities by indicating the nature of teacher's feedback reaction to the target student's answer. This

Notice that the section of the coding sheet for teacher feedback is different from the other sections of the sheet. The circles in the feedback section contain the numerals 1, 2, and 3. These numerals indicate the order of occurrence of types of feedback in situations where the teacher gives more than one type of feedback to a single student response or student question. Four types of teacher feedback are coded in this system: positive feedback, neutral feedback, negative feedback, and sustaining feedback. At times, the teacher will give more than one type of feedback for a given student response. For example, when a target student answers a question incorrectly and the teacher responds by saying that the answer is incorrect, at times the teacher continues with that student by asking the same question but in a rephrased form. Under these circumstances the teacher has used two different types of feedback with the student. The teacher has used negative feedback followed by sustaining feedback. This coding sheet maintains the ordering of the types of feedback given. So for the example given above, the one-circle should be marked for negative feedback since the negative feedback was given first. The two-circle should be marked for sustaining feedback since that feedback was given second. The four types of teacher feedback to be coded are described below.

The first three feedback categories (positive, neutral, and negative) are designated as "terminal" feedback, which differs from "sustaining" feedback. *The categories of sustaining feedback include teacher behavior which prolongs the response opportunity by providing a second chance to deal with the same or related questions. Use of sustaining feedback reactions is an index of the teacher's willingness to stick with the target student until she/he can produce an acceptable answer. Terminal feedback, on the other hand, brings the response opportunity to a close. With terminal feedback* *reactions, the teacher either gives the target student the answer or sees that she/he gets it from someone else, or merely makes a feedback or evaluation response without supplying the answer. In either case, the teacher does not sustain the interaction and provide additional response opportunities.*

At times, teacher feedback to a target student may contain comments which are of interest other than as feedback reactions. When the teacher gives feedback which contains certain types of comments, the teacher's behavior is coded in two different places on the coding sheet. Since the teacher has given feedback to the target student, the appropriate feedback category or categories are coded. At the same time, the teacher may have commented about confidence, usefulness, stereotyping, enjoyment, expectations, or attributions. These aspects of the teacher's feedback are noted either under Teacher Comments or are written with Observer's Notes. A description of the coding procedure for teacher comments is given after the section in this manual concerning non-public teacher-student contacts.

Positive Feedback

Positive feedback is coded whenever the teacher affirms that the target student's response is correct or the teacher praises the target student in some way as feedback to a student response. In the event that the teacher expresses both praise and that the student's response is correct without any other type of feedback in between, only one positive feedback is recorded. Positive feedback may be indicated either verbally ("Yes," "That's right," "Okay," "Great!" etc.) or non-verbally (shaking head up and down). At times teachers may habitually respond to any student response with "Yes," or "Okay." Even though this feedback may appear to have a neutral effect on students, it should still be coded as positive feedback.

Neutral Feedback

Neutral feedback is coded when the teacher gives no feedback to the target student or when the teacher asks another student the qeustion without indicating whether the first student's response was correct or incorrect. Thus, feedback which does not indicate the correctness or incorrectness of the target student's response and at the same time does not praise or criticize the target student's response is coded as neutral feedback.

Negative Feedback

When the teacher responds to a target student's answer by indicating that the student's answer is incorrect, this is coded as negative feedback. In addition, any instance of teacher anger, criticism, or disgust expressed in response to a student answer is coded as negative feedback. Negative feedback may be expressed either verbally or non-verbally.

Any verbal response which disparagingly refers to the target student's intellectual ability, or more frequently, his/her motivation to do good work, is coded as negative feedback. Statements of the latter type by the teacher may be factually true (i.e., the student may not have been paying attention) or may be unverifiable gratuitous rejection ("You just don't care."). Both are nevertheless coded as negative feedback, since this coding refers to the teacher's behavior per se and not to the veracity or justification for teacher statements. Some types of criticism should be coded in Teacher Comments in addition to being coded as negative feedback.

Sustaining Feedback

This category is sustaining feedback, in which the teacher sustains the response opportunity and provides the target student with a second chance to respond. A first example of such a reaction is when the teacher simply repeats the question. This will almost always occur when the target student has made no response, although it may also occur at times in which he/she has given an incorrect response. In any case, if the teacher asks a question, waits some time without getting the correct answer, and then repeats the question to the same target student, his feedback reaction is an example of sustaining feedback. The teacher need not repeat the entire question word for word in order to be coded in this category. Truncated versions of the original question and short probes to determine if the target student can make any response to the original question, are both coded as sustaining feedback. For example, to the original question, What is the answer to #24?" the following responses are all coded as repeats question: "What number?," "Well?," "Do you know?," "John?" (The latter said in a manner that communicates that the teacher is waiting for the target student to respond to the original question).

Another example of sustaining feedback occurs when the teacher sustains the response opportunity by rephrasing the question or giving the target student a clue as to how to respond to it. Usually the rephrasing of the question in this situation will be such as to simplify it, particularly in moving from one question ("What do we call this type of fraction?") to a simpler question ("Is it proper or improper?"). Rather than rephrase the question in this manner, the teacher may provide a clue expressed as a declarative statement: "Its value is greater than 1."

The material provided by the teacher in rephrasing the question or giving a clue may or may not be helpful for the target student -- certain types of clues may actually confuse rather than help. This fact should not be allowed to influence the coding. So long as the teacher does something which is intended by the teacher to help the target student answer the original question, the teacher's action is coded as sustaining feedback.

Sustaining feedback is also coded when the teacher asks a new question of the same target student as feedback that target student's response. *The occurence of sustaining feedback presents a special coding problem because this type of feedback gives the target student a new response opportunity. This new response opportunity must then be coded for level of question, quality of answer and additional feedback from the teacher. At the same time, the fact that it is a follow-up to an original response opportunity rather than a wholly new response opportunity must be maintained in the coding system. This is accomplished by skipping down to the next row whenever sustaining feedback is coded, thereby bringing a close to the coding of the original response opportunity and beginning the coding for the follow-up response opportunity. On the next row, the level of question, the quality of the target student's answer and the nature of the teacher's further feedback is coded but the target student's number is not repeated in the student number section. Thus, coding of question type and identification of the number of the target student involved is done only for original response opportunities; follow-up response opportunities occuring due to sustaining feedback in reaction to the original response opportunities are coded only for level of question, quality of target student's answer and type of teacher feedback.*

Proper coding of such a sequence is exemplified in rows 2, 3, and 4 of the sample coding sheet found in Appendix Two. *Beginning in row 2, the coding example implies that the teacher asked a direct question of target student number 6, that the question was a product question, that the target student failed to give a response and that the teacher reacted in this instance by repeating the question. After coding the preceding information as in row 2 in the example, the coder then moves down to row 3 and codes the information there which* *says the following: The question is a product question (since it is a repeat of the original question); the target student this time answers incorrectly; the teacher reacts this time by negating the wrong answer and then by rephrasing the question or giving a clue. Since this sequence also culminates in the appearance of sustaining feedback, as noted by the "2" under the* ***sustaining*** *column, the coder again skips a row and codes the third response opportunity of the sequence in row 4. In this instance, the coding in the example tells that the rephrased question was a product question; that the target student responded correctly this time; and that the teacher reacted by affirming the target student's response as his terminal feedback. Thus, in the example provided an original response opportunity as noted in the column under the* ***direct questions*** *eventuated in three different response opportunities, each of which was coded for level of question, quality of target student's response and the type of teacher feedback. The coding allows for retention of all of this information in the sequence in which it occurred, as in the example in Appendix Two. The fact that the sequence occurred as an original response opportunity that was followed-up by two others rather than three separate and unrelated response opportunities is also preserved in the coding.*

Other than the special conditions requiring skipping to a new row when sustaining feedback occurs, the coding of teacher's feedback reaction simply involves noting the appearance of new codable feedback categories in the order in which they appear. The coder merely enters a "1" in the appropriate column for the teacher's first codable reaction; any additional codable reactions are numbered consecutively thereafter.

Since it is rare for more than three such responses to occur as teacher feedback to a single response by the target student, only three columns are printed on the coding sheet. Thus, the observer codes the first three teacher feedback responses as described above and must ignore any further feedback to a single student response. If a fourth or fifth feedback response is particularly noteworthy, the observer should note its occurrence in the Remarks section on a separate sheet of paper.

Redundant repetitions within the category of terminal feedback are not multiply coded. For instance, the comment "Yes, that's right, it's improper" would simple be coded as one affirmation of the correct response (not as three such affirmations).

NON-PUBLIC INTERACTIONS

The preceding material has dealt primarily with the coding of response opportunities. Description of the coding procedures involved has frequently been complicated because of the many distinctions to be made and the necessity for maintaining the sequence of events in the coding of the interactions. The coding of non-public interactions to be described below typically requires only the entry of the target student's identification number in the proper place on the coding sheet and coloring in the appropriate circle to describe the interaction.

Non-public teacher-student contacts differ from response opportunities in that the teacher is dealing privately with one target student about matters idiosyncratic to him/her rather than publicly about material meant for the group or class as a whole. The latter distinction is the key one, since non-public teacher-student contacts are not always private (the teacher may talk in a loud voice or address the child from across the room). Such interactions are nevertheless coded as non-public as long as they involve matters idiosyncratic to the target student and are not public questions (response opportunities).

Non-public interactions are divided into procedural contacts, work-related contacts and behavioral or disciplinary contacts. They are also separately coded according to whether they are initiated by the teacher (teacher-afforded) or by the student (student-created). The coding also reflects certain aspects of the teacher's behavior in such contacts.

Work-Related Contacts

Work-related contacts include those teacher-student contacts which have to do with the pupil's completion of seat work or homework assignments. They include clarification of the directions, soliciting or giving help concerning how to do the work or soliciting or giving feedback about work already done. Work-related interactions are considered student-created if the target student takes it upon himself to bring his work up to the teacher to talk to him about it or raises his hand or otherwise indicates that he wants to discuss it with him. Work-related interactions are coded as teacher-afforded if the teacher gives feedback about work when the target student has not solicited it (the teacher either calls the target student to come up to his desk or goes around the room making individual comments to the students). Student-created contacts are not planned by the teacher and occur solely because the target student has sought him out; teacher-afforded contacts are not planned by the target student and occur solely because the teacher initiates them. Separate space is provided for coding student-created and teacher-afforded work-related interactions on the coding sheet, and the coder indicates the nature of an individual dyadic contact by where he/she codes the interaction.

In addition to noting the interaction as a work interaction and as an interaction which is student-created or teacher-afforded, the coder also *indicates the nature of the teacher's feedback to the target student during the interaction. He indicates this by using one or more of the five columns provided for coding teacher's feedback in work-related interaction: praise, process feedback, product feedback, criticism, or "don't know". The first four of these categories have the same meaning as they have in other coding of teacher feedback. The additional "don't know" category is added for this coding because frequently the individual teacher-student interaction that occurs in the dyadic contacts will be carried on in hushed tones or across the room from the coder where she/he cannot hear the content of the interaction. In such cases, where she/he is unable to code the nature of the teacher's feedback because she/he cannot hear it, the coder notes the occurence of the work-related interaction and the fact that it was either teacher-afforded or student-created, but enters the target student's identification number in the "don't know" column. Coders should note that the "don't know" column has a very special and specific meaning for this coding. It should be used only when the coder cannot hear the teacher's feedback. It must not be used when the coder is unsure about whether to code the teacher's feedback as process or product. Thus, use of this column signifies that the coder could not hear the interaction, not that she/he has difficulty in making a coding decision on the basis of something that she/he was able to hear. When a coder is unsure as to whether to code process or product feedback, she/he should code product feedback as in any other situation. Similarly, if she/he is unsure whether to code praise or criticism in addition to feedback, she/he should code only feedback, thus preserving the coded instances of praise and criticism to those cases in which the coder was sure of the coding. Thus, entries in the "don't know" column will indicate solely that the coder could not hear the teacher feedback in the interaction involved.*

Coding of work-related interactions according to the principles above is exemplified in rows 10, 11, 12, and 13 of the Teacher-Student Interaction coding sheet in Appendix Two. The number "4" in row 10 indicates that the target student whose number is 4 approached the teacher to discuss his/her work and was given product feedback. Similarly, the "2" in row 11 under the feedback column for afforded work-related interactions indicated that the teacher initiated an interaction with target student number 2 regarding his/her work and also gave product feedback. Thus, both of the preceding teacher-student contacts were related and involved the teacher giving product feedback to the student. However, the contact involving target student number 4 was initiated by the student, while the contact involving target student number 2 was initiated by the teacher. This difference is reflected in the placement of the two numbers on the coding sheet. Similarly, the number "0" in row 12 under the "don't know" column for created work-related interactions indicates that target student number zero sought out the teacher to discuss his/her work but that the coder could not hear the interaction and therefore could not code the nature of the teacher's feedback.

The coding in row 14 under created work interactions illustrates the procedure to be followed when the teacher's feedback includes more than one codable category. The placement of the number "5" indicates that target student number 5 sought out the teacher to discuss his/her work and that the teacher responded with product feedback. The mark under the "praise" column in the same row indicates that in addition to giving him/her product feedback the teacher also praised him/her.

The coding steps to be taken in the coding of work-related contacts may then be summarized as follows: (a) the coder enters the student's number; (b) the coder determines whether the contact is initiated by the teacher or by the student; (c) the coder then determines that the contact is indeed a work-related contact and not one of the other types of teacher-student contacts; (d) the coder notes the teacher's response to the student or the feedback given to him/her and at this point darkens the appropriate circle; (e) should the teacher produce additional feedback responses to the target student besides that already indicated in the coding, the coder darkens additional circles next to the original one darkened.

PROCEDURAL CONTACTS

The category of procedural contacts includes all dyadic teacher-student interaction which is not coded as work-related contacts or as behavioral contacts. Thus, it includes a wide range of types of contacts, most of which are initiated on the basis of the immediate needs of the teacher or target student involved. Procedural contacts are initiated by the target student for such purposes as seeking permission to do something, requesting needed supplies or equipment, reporting some information to the teacher (tattling on other students, calling the teacher's attention to a broken desk, etc.), getting permission or information about how to take care of idiosyncratic needs (going to locker, getting a pass to get help during another period, etc.), as well as a variety of other contacts. In general, any dyadic interaction initiated by the target student which does not fit the definition of work-related contacts is coded as a procedural contact. Procedural contacts initiated by the teacher usually have to do with classroom management or with the teacher being aware of and handling some idiosyncratic need in the target student. Examples include asking individual target students to run errands, carry out a particular clean-up job, pass out equipment or supplies, and similar interactions in which the teacher enlists the target student's aid in classroom management, as well as contacts initiated by the teacher to handle a particular situation idiosyncratic to the target student involved (to see of he/she is sick, to give him/her a note to take home to his/her parents, etc.). In general, any dyadic interaction initiated by the teacher that does not fit the definition of work-related interactions or behavioral interactions is coded as a teacher-afforded procedural interaction.

As with work-related interactions, procedural interactions are separately coded on the coding sheets according to whether they are teacher-afforded or student-created procedural contacts, the coder indicates the nature of the teacher's response in addition to the target student's identification number. Three categories for coding teacher's response are provided: praise, feedback, and criticism. Praise and criticism have the same meaning here as elsewhere and are coded if they occur as part of the teacher's response. All teacher reactions to student-created procedural contacts which do not contain praise or criticism are coded as feedback. This means that a large variety of teacher reactions will be coded in the feedback category, reflecting the heterogeneity of types of procedural contacts. Thus, coding of a created procedural contact with teacher feedback means that the teacher responded in some way to the target student's expressed need or question without either praising or criticizing him/her. The numbers in rows 15, 16, and 17 of the created procedure Non-Public contact column in the example Teacher-Student Interaction sheet in Appendix Two exemplify the proper coding of these instructions. In row 15, the number 6 and the other darkened circle indicate that target student number 6 approached the teacher on a procedural matter and was criticized by him. The mark in the feedback column next to the criticism indicates that the teacher also gave some feedback to the target student's need in addition to criticizing him. The criticism involved may have been due to the fact that the target student left his/her seat to come and see the teacher, or it may have been connected with the particular procedural matter that the target student took up with the teacher. In any case, the coding indicates that the target student did in fact approach the teacher on a procedural matter, that the teacher's response was to criticize him/her for something, and that the teacher also gave feedback regarding the procedural matter itself. The numbers in the rows 16 and 17 indicate that target student number 0 and target student number 1 came to the teacher on procedural matters and were given feedback regarding those procedural matters without any teacher praise or criticism being involved.

Occasionally, there will be difficulty determining whether a given teacher-student dyadic contact should be coded as work-related or procedural. Most confusion will be eliminated in this area if it is remembered that any questions or clarification about the directions for the assignment involved are coded as work-related, while questions having to do with equipment or supplies are coded as procedural. Thus, if the target student asks the teacher to repeat the page numbers that he/she is supposed to complete in his/her workbook, asks if he/she should start the assignment right now or later, or has some other question regarding the immediate specifics of the assignment, the interaction is coded as a created work-related dyadic contact. On the other hand, if the target student comes up to the teacher before starting his/her assignment because he/she needs a pencil, has run out of paper or has some other problem with supplies, the interaction is coded as a created procedural dyadic contact.

BEHAVIORAL CONTACTS

Behavioral contacts are coded whenever the teacher makes some comment upon the target student's classroom behavior. They are subdivided into praise and criticism. The coder notes the information by entering the target student's identification number and darkening the circle in the appropriate column. Behavioral evaluation contacts are considered to be teacher-afforded, although they usually occur as reactions to the target student's immediately preceding behavior. Nevertheless, they are teacher-afforded in the sense that the target student usually does not want and does not expect the interaction and the teacher chooses to single the target student out for comment. The conditions for coding this category are: (a) the teacher singles out the target student for comment upon his/her classroom behavior; (b) the interaction concerns only his/her behavior and does not involve praise or criticism in connection with work-related or procedural contacts as defined above. Some behavioral criticism may occur in work-related and procedural contacts and in those situations, it appears in the coding for work-related and procedural interactions. The category of behavior interactions is used only for those instances in which the teacher singles out the target student for comment solely on the basis of wanting to discuss his/her classroom bahavior. Work-related or procedural matters are not involved.

Praise

This category will be used relatively infrequently with most teachers, although it will occur. Occasionally, target students will be singled out for special praise for their classroom behavior. Praise coded in this category will also sometimes occur after activities but not in relation to specific responses during those activities ("Pat must have studied hard last night."). Idiosyncratic teacher euphemisms that carry the same sorts of meanings as the preceding examples are also considered to be praise ("Lee is really hanging in there today."). Whenever the teacher singles out a target student for such praise, coders should enter the target student's identification number in the praise column under behavioral teacher-afforded contacts.

Warning or Criticism

This category refers to teacher behavior in singling out for comment a target student engaging in inappropriate or undesirable classroom behavior. Comments which function as either warnings or criticism are coded in this category. *Usually teacher's warnings will occur in situations in which the target student is doing something that is not necessarily or always prohibited but which is troublesome at the moment. In such instances, the teacher will single out the target student to inform him/her that his/her present behavior is inappropriate. Examples of this are as follows: "Lee, you're getting too noisy" "Try to figure out the answer on your own, don't copy from your neighbor" "Pat, you can talk to Bill if you want to, but stay in your seat."*

Behavioral instructions given to the child merely in the interest of information or classroom management and without any connotation of warning or criticism would be coded as teacher-initiated procedural contacts. The same instructions given in a slightly different context which connoted more of a warning and perhaps implied that the child should know better ("John, sit down, Mary can't see when you stand up like that.") would be coded as behavioral warning or criticism. If the same sentence were snapped at the child or delivered with anger or exasperation, it would also be coded as behavioral warning or criticism.

Coding of behavioral evaluation is exemplified in the final three columns of the Teacher-Student Interaction coding form in Appendix Two. The marks in the next to the last row indicate that target student number 6 was singled out for praise by the teacher. The marks in the last row indicate that the teacher delivered behavioral warning or criticism to target student number 2.

TEACHER COMMENTS

For the purposes of this study, certain types of teacher comments directed to individual target students in public or privately, are to be recorded. The instructions for noting teacher comments are given in Appendix Three.

GENERAL CODING CONVENTIONS: VALIDITY

Certain general coding rules and conventions have been established which cut across all the coding categories and which may be relied upon for guidance in determining what to do in ambiguous situations. These conventions were established with particular attention to the problem of ensuring the validity of data in studies of teacher communication of expectations through differential behavior toward different students. The basic general conventions are as follows:

1. *Nothing is coded whenever the coder is not sure which target student was interacting with the teachers. Do not guess about the identity of the target student. This convention is important to avoid contamination of observation data by the expectations of the coder. Guesses about the identity of the students in ambiguous situations are likely to be influenced by the*

coder's expectations of which students would be likely to have the sort of dyadic interaction with the teacher that has just occurred. While this problem will occur rarely, it sometimes does happen that the coder is aware of a dyadic interaction but was not able to determine which student was interacting with the teacher. In these situations, the occurrence of the dyadic interaction is ignored, and nothing is coded at all.

2. The coder makes decisions concerning the correctness of a target student's answer by noting the teacher's reaction to the answer. *If an ambiguous or even a correct answer is considered to be incorrect by the teacher, it is coded as incorrect in coding the target student's answer. Similarly, the teacher may ask one type of question but phrase it ambiguously so the target student can respond to it in a different way. Consider the following example:*

TEACHER: John, can you tell me how much 3/4 times 8/9 is?
JOHN: Yes. (This response is possible, although it occurs rarely.)
TEACHER: Well, how much is it?
JOHN: Two thirds.

The preceding example and similar situations should be coded as single instances of product questions, not as non-mathematics questions followed by product questions.

Teachers may frequently ask rhetorical questions in which they do not expect the target student to produce an answer. These are not considered to be questions and are not counted as response opportunities for the target student even if the target student should overtly answer the question ("The distance is over 100 miles, isn't it?"). On the other hand, product questions similarly phrased which the teacher is treating as questions and which she/he expects the target student to respond to are treated as questions and are coded under response opportunities. When the coder is uncertain, no response opportunity is coded.

Coding of evaluative reactions also depends on the teacher's behavior, not on the target student's reaction. Thus, a teacher who verbally criticizes the target student is coded for criticism, whether or not the target student reacts to this criticism. On the other hand, a particularly sensitive target student might become upset upon being given simple negation following a response. The fact that the target student may react as if he/she has been criticized does not mean that the teacher is to be coded for criticism, when the teacher has simply stated that the student's answer is wrong.

3. Coders should be thoroughly familiar with rules regarding the handling of ambiguous coding situations. For each borderline between related categories there is a rule stating what to do in situations in which the coder cannot decide between the two categories. These rules should be memorized and used universally so that certain categories can be kept "clean" and restricted to situations in which the coder was sure of his/her rating.

4. The teacher-afforded and student-created non-public interactions (work-related, procedural, or behavioral) are coded as single units if uninterrupted, regardless of how long they go on. This means that if the teacher should launch into an extended process review of the work with the target student in a work-related dyadic contact, the coder nevertheless notes only one unit for an afforded or created work-related contact and only one unit of

process feedback in that contact. Any codable teacher behavior during the contact is noted with the target student's identification number and by darkening the appropriate circle(s).

But it is noted only one time and repeated instances of the same type of behavior are not multiply coded. Similarly, in giving feedback to the target student in an individual contact such as this, the teacher might ask several questions as a way of helping him/her discover how to do the work. Such questions are occuring as part of the teacher-afforded or student-created work-related contact and therefore are not coded as response opportunities since they are not public questions. This convention may appear unwarranted to illogical at times, especially when a particularly long and noteworthy dyadic interaction is observed, but it is consistent with the other facets of this measurement approach. To code more than one dyadic contact in such situations, or to attempt to multiply code the separate units of teacher behavior that might occur during a single unit, would be to introduce inconsistency that would dissipate the validity of frequency measures for the dyadic contact categories. For example, if difficulty in understanding the teacher produced longer average interactions and a greater number of teacher messages per interaction, the less-able target student would be credited with a greater number of such interactions and/or a greater richness of interaction than would a target student who was able to understand and more quickly incorporate the teacher's feedback. This is in a sense a special case of the more general principle mentioned above: The coding must reflect the teacher's behavior rather than the target student's response to it.

5. Occasionally, unforeseen types of response opportunities or other classroom events will occur in which the coder is not sure whether to code the situation at all, or is not sure how to code it if she/he thinks it

should be coded. In these situations, the coder should code the interaction in whatever manner makes sense to her/him at the time, but she/he should be sure to indicate the units involved very clearly with a faint pencil mark and should at the first opportunity explain the situation in detail in the "remarks" section on another sheet of paper. These special situations should then be discussed with the project investigators as soon as possible (before the details are forgotten), so that determination can be made as to whether the data should be included in the study. In the present research, this problem has come up with regard to games and other non-academic classroom activities. Recess, free play, and other obviously non-academic activities are not being coded. However, teachers will sometimes institute games which may be considered mathematically relevant. In such situations, the activities of the children may then be coded as response opportunities and/or recitation turns with the special nature of the activity noted through placement of "X's" in the left margin and description of the activity involved in the "remarks" column. Determination of whether or not to use these data is made on the basis of whether or not the activity seems to involve enough elements of academic work to justify considering the response demands of the activity as response opportunities as defined above. If it is determined that the activity did not involve sufficient academic content to be comparable to the more clearly academic response opportunities, or if it is clear that the participation of the children was not under the control of the teacher (thereby making it not comparable with other coded activities), the data are excluded from the general analysis.

7. Praise and criticism are regularly coded teacher reactions, although there are many different columns and places for coding them, depending upon the context in which they occur. It is therefore important to avoid double coding these teacher behaviors. Frequently, in a teacher-afforded or student-created work-related contact, for instance, the teacher will not only criticize

the work *per se* but go on to note that the work is poor primarily because of poor attention or other maladaptive classroom behavior. In one sense, this criticism may be seen as behavioral rather than as work-related criticism. However, since it occurs during a work-related dyadic contact rather than in a contact initiated by the teacher solely to criticize the target student's behavior, it is coded in the criticism column under work-related dyadic contacts (afforded or created, as appropriate). The coder does *not* make an additional coding in the criticism column for behavioral evaluations. The coder may, however, code a *teacher comment* along with the single praise or criticism coding.

8. In coding response opportunities, coders should be sure *not* to repeat the target student's identification number when sustaining feedback is involved. This caution is necessary because in the present system, the only method of obtaining an accurate count of *original* response opportunities is to count the number of times the target student's number appears in the response opportunity coding sections. This total will ordinarily be smaller than the total for answers given by the target student, since whenever sustaining feedback occurs, a new answer will be coded and the original response opportunity will have led to more than one answer from the child. Coders should also bear in mind that each response opportunity must be coded at the end for one or more types of terminal feedback. Be especially alert to mark *neutral feedback* in terminal feedback situations where this is appropriate. This is easy to forget.

PART II

INTRODUCTION

This part of the manual describes the coding system used to study the proportion of time students are engaged in mathematics learning activities and some of the characteristics of these activities. This system has been adapted from one developed by the Far West Laboratory for use in the Beginning Teacher Evaluation Study. Portions of the manual written by Romberg, Small, Carnahan and Cookson at the Wisconsin Research and Development Center for Individualized Schooling have been used directly in this manual. These portions are written in italics.

The most important features to be observed are the characteristics of the activities target students engage in and the degree to which these students discuss mathematics with their peers. The physical location of the teachers and target students is also recorded.

OBSERVATION PROCEDURES

A "target population" of six to ten students from the class will be observed. The names of the target students, selected in advance, will be given to each observer prior to the first observation. The target students will remain the same for the duration of the study. The general procedure for using the observation system is one of "time-sampling." This means that each target student will not be observed continuously, but rather in a particular sequence at different moments during the observation period. The sequence or order of observation is determined by the observer before the observations begin and is maintained for the complete class period. Seating arrangement and grouping are some considerations to make in determining the sequence. The sequence can be changed for each new observation period. The observation of each target student composes a cycle It is estimated that thirty seconds is needed: 1) to observe the activity that each student is involved with, 2) to code the appropriate categories on the coding form (See Appendix Two). The behavior to be coded consists of only those things that the target student is doing precisely at the 10 second mark of the thirty second interval. This procedure is designed to minimize the possibility of observer bias in sampling the moments. Codes are used to record a description of the event happening at the one moment in time to a target student. The collection of codes from several moments will provide a series of "snap shots" of what the observed student does during the observation period.

The beginning and ending of the observation period coincide with the beginning and ending of the time period allocated to mathematics, although it would be wise to spend a minute or two at the first of the period to get a "feel" for the class. It is very likely that the students will be involved in some transitional activity or other content area at the very beginning or ending of the period. These activities are not to be coded

If the period is not fixed and depends upon when work in another content area stops or begins, the observation period begins when the teacher redirects the students to mathematics and ends when the teacher redirects the students to some other area.

Immediately following the observation period or as soon as is practical, classroom data are recorded and the observation checked. This information and the coding are reviewed for any inconsistencies.

GENERAL PROCEDURES FOR TIME-SAMPLED OBSERVATION

Target Student Recognition

The names of the target students will be given to the observer prior to the first observation. The first task for the observer is to learn to identify each of the target students by name and face. Students will get up and move *around the room, so the observer must be able to identify each target student by means other than seating location.*

It is extremely important that the target students and their teacher do not know which students in the class are being observed. The observer must take care not to observe target students in such a way as to make clear to anyone in the class the target students' identity. Seating charts should be kept well hidden from view during observation and should not be left loose in the classroom. When target students move around the room during mathematics class, the observer should be very careful not to be too obvious in following them. If a target student leaves the classroom for any reason, he/she should be coded as absent.

Avoiding Communication with Students

Another procedure that should be followed during observation is the avoidance of communication with any students. In fact, it is usually advisable to concentrate on the observation and coding so intently that eye contact with students is avoided. Students will tend to ask observers for help with their work, or will ask about what the observer is doing. Observers will find that they do not have time to help students and code observations simultaneously and that a student who has been given help once will expect to receive it whenever it is requested thereafter. It is less distracting to provide terse explanations of what the observer is doing, but even this presents problems when the student is not satisfied with a terse statement. The most reliable procedure is to concentrate on coding observations and avoid even eye contact with students. The routine response to any student question should be either no response or the statement that both you (the observer) and the student have work to do and should not be talking.

Outside of the classroom, it is possible to maintain a more cordial relationship with the students. However, it is extremely valuable to set the standard of no communication inside the classroom. Students will recognize and accept this distinction.

Sampling Moments

Target students must be observed in the same order throughout the observation period. This ordering is to be done by the observer and can take into consideration seating arrangement. However, once an order has been determined, it should not be changed. The sampling of moments should occur in regular cycles. The first sample of a moment should be near the beginning of the period allocated to mathematics. The "picture" at the ten second mark of the observation of a target student must be the moment coded. The observer "takes a mental photograph" of that moment, then decides how it *should be coded and marks the appropriate categories on the form. This kind of procedure is necessary to minimize observer bias in the sampling of moments. Distinct events often take place in a rapid sequence. The observer must be very rigid in coding the precise moment first observed to prevent confusion in determining which of several events should be coded. It is estimated that observing the moment, making a mental note and coding will take thirty seconds. Variation from this time is acceptable. What is important is that the moment sampled is precisely coded.*

Investigating the Moment Sampled

Once the observer has sampled a moment, storing a mental photograph of that moment, then it is possible to conduct brief observations thereafter to determine what coding categories best describe that moment. That is, the observer can thereafter walk over to examine the page that the student was working on. The observer still codes what the student was doing at the moment first observed but uses the new information to record the appropriate content category. In all cases, it should be clear that the moment to be coded is the one that was sampled at the ten second mark. The subsequent observations are carried out simply to determine what that moment really was.

Attending to Non-Target Students

It is nearly impossible to prevent target students from realizing they are the focus of the observations. The avoidance of eye contact will help to reduce that extent to which target students feel self-conscious. In addition, it is helpful to keep the observation sheet out of the view of any students. This will prevent students from reading the name of the target student(s) written on the form. However, the best procedure for reducing target student awareness of the observation is to attend to non-target students. This can be done by asking non-target students questions and observing what materials they are using. At times, non-target students will be engaged in *similar activities as the target students. Thus, it is possible to code the target student behaviors by observing non-target students.*

Checklist

At the end of the observation period, the observer should refer to the checklist for coding and error control (See Appendix One). In addition to completing all information, the observer should review this checklist and his/her coding form, looking for coding errors.

TIME-SAMPLED OBSERVATION CATEGORIES

The following is a list of the time-sampled observation categories to be used with descriptions of each. For each category, a brief description is given first. Following this brief description is a more detailed explanation.

Attendance

A = Absent

Target student is absent during the observation period.

This is used to indicate that the target student is not at school, or is otherwise unavailable to be observed.

A brief trip to the washroom or water fountain is not coded as absence. Do not replace an absent target student with another student during the observation period. Continue to code the target student as being absent for each cycle.

Student Engagement

E = Engaged

The student is engaged in a purposeful learning activity related to mathematics content.

O = Off-task

Off-task describes the student when she/he is not engaged in a task.

The most important information obtained by the coding of pupil activity is the engagement or lack of engagement of the student when working on mathematics. That is, the crucial information to be obtained is the determination of whether or not the student is actually working on a mathematics task. If the student is engaged, then engaged (E) is coded. If the student is not engaged, then off-task (O) is coded.

The determination of engagement or non-engagement is central to the coding of pupil behavior, because this distinction is the most important of those involved in the time-sampled observation categories. Whenever there is ambiguity regarding student engagement, the observer should give the student the benefit of the doubt and code engaged. Off-task should be coded only when it is reasonably clear that the target student is not engaged in a purposeful mathematics task.

Several rules are necessary for the coding of engagement. If the target student is engaged in a mathematics activity, this is coded as engaged even though the teacher has assigned some other activity. If the student displays both a non-engaged and an engaged behavior for the same activity, then the engaged behavior is coded. For example, the student might listen to the teacher's explanation or directions while sharpening a pencil. In such cases, the engagement is coded. The student can be engaged in two activities at once such as copying one part of an assignment while listening to the explanation or direction of the teacher. If one of the activities is a process activity and the other is a product activity, the level of engagement should be coded as process (S).

If the target student is not engaged in a mathematics activity, then this non-engagement is coded even when the student is engaged in an alternative activity other than a mathematics activity. The teacher could tacitly accept the off-task activity of the student. For example, a teacher might interrupt a student's mathematics seatwork to ask about the outcome of a baseball game played the day before. In this case, the target student is *coded as off-task. The teacher's obvious acceptance of this socializing does not change its off-task characteristics in relationship to mathematics. Note that the coding is exactly the same if another student interrupts the target student to ask about the baseball game.*

The off-task code is used in some cases where the teacher overtly states that the student may leave a mathematics activity temporarily for some other purpose. For example, a student may leave the room to get a drink or to use the restroom during an ongoing mathematics activity. This is coded as off-task even when the teacher tells the student (overtly) that he/she may leave to get a drink or use the restroom.

Level of Engagement

(Level of Engagement is coded only when the student is coded as Engaged.)

S = Process

Engagement at the process level requires that the student be working on something that requires him/her to integrate facts or to show knowledge of their interrelationships. This level is generally in response to a "how?" or a "why?" question.

T = Product

Engagement at the product level requires that the student know a specific fact but does not require that the student integrate several facts or make inferences from them.

The process level is the most complex level of engagement. In it, the student is required to integrate facts or to show knowledge of their interrelationships. It most frequently is an activity that asks "why?" or "how?." A process activity requires the student to specify the cognitive and/or behavioral steps that must be gone through in order to solve a problem or come up with an answer.

The answer in a product activity can usually be expressed in a single word or a short phrase. Product activities differ from process activities in that they only require knowledge of a specific fact and do not force the student to integrate several facts or to make inferences from them.

Spatial Engagement

(Spatial Engagement is coded only when the student is coded as Engaged.)

SV = Spatial

The target student is coded as engaged in a spatial activity when it is apparent that she/he is using spatial visualization or is drawing a picture to aid in solving a problem or in understanding a mathematical concept.

NS = Non-Spatial

The target student is coded as engaged in a non-spatial activity (NS) when he/she does not appear to be using spatial visualization or a picture to aid in learning mathematics.

Peer Interaction

(Peer Interaction is coded only when the student is coded as Engaged).

P = Peer Interaction

A target student is coded as interacting with a peer (P) when he/she is working on some mathematical concept or problem with one or more peers.

NP = No Peer Interaction

The target student is not interacting with peers (NP)

Teacher and Student Location

The first time the observer works in a classroom, she/he will make a sketch of the classroom. The classroom layout sketch should include the teacher's desk(s) and the arrangement of the student desks and work tables. Copies of this sketch will be provided for the observer to use in subsequent observations.

At the end of each observation session, the coder records the location where the teacher spent the majority of the class period. In addition, the coder records the location where each target student spent the majority of the period.

APPENDIX ONE

Continuous Observation -- Quick Reference Outline

Response Opportunities

response opportunity	Response opportunities are public interactions between the teacher and only one student at a time. They may occur in a large group or small group (2 or more students) setting. They occur when the teacher asks a question to which a target student is to publicly respond. The question is responded to by only one student, in this study, a target student.
student-initiated	Response opportunity initiated by a target student.
discipline question	This is a question asked by the teacher in a public setting. Teacher gives some indication that the question is asked to compel the target to pay attention.
direct question	Teacher calls on a target student who has not volunteered.
open question	Teacher asks a question and calls on a target student who has volunteered to respond to the question.
call out	A target student calls out the answer to a question before the teacher has a chance to call on anyone. The teacher responds to the student who has called out the response

Level of Question

process question	This is a mathematics question which requires the target student to give the steps that must be gone through to solve a problem. It is generally a "why?" or "how?" question.
product question	A product question is one which requires the target student to answer with a single word or phrase without indicating how the answer was found.

non-mathematics question	Such a question does not require the target student to show skill or knowledge of mathematics. The teacher does not evaluate the student response as correct or incorrect.

Student's Answer

correct answer	Student's answer is considered correct unless the teacher makes some action suggesting dissatisfaction with it.
part-correct answer	Teacher indicates that target student's answer is correct but incomplete, or that the response is correct but not the answer the teacher is seeking.
incorrect answer	Teacher indicates that the target student's answer is wrong by saying so, providing the correct answer, or asking someone else.
no response	Student indicates that he/she cannot answer the question or student remains silent.

Teacher's Feedback Reaction

positive feedback	As feedback, the teacher compliments the target student or makes a gesture indicating warmth or excitement. Also includes teacher feedback which indicates that the student's response was correct. (Examples: Good, Fine, Wonderful, That's right, Yes)
neutral feedback	Teacher makes no response whatsoever to target student's response, or teacher continues without indicating whether student's response was correct or incorrect.
negative feedback	The teacher provides impersonal feedback that the target student's response is not correct, or the teacher expresses personal criticism or anger.
sustaining feedback	The teacher attempts to stay with a target student so that he/she can answer the question asked. It may consist of repeating the original question, rephrasing the original question, giving some type of clue, or asking a new question.

CODING INSTRUCTIONS

sustaining feedback	Whenever sustaining feedback is coded, the coder skips to the next line to code the level of the question, the target student's response, and the nature of further feedback given by the teacher. If further sustaining feedback is given to this second response opportunity, the coder once again skips to the next line and codes the level of the question, student response and teacher feedback.

Teacher Comments

confidence - positive	Teacher comments that the target student is confident in her/his ability to do mathematics.
confidence - negative	Teacher comments that the target student is low in her/his confidence in mathematics.
confidence - neutral	Teacher comments about target student's confidence without making a positive or negative comment.
usefulness - positive	Teacher says that mathematics will be useful for the target student.
usefulness - negative	Teacher says that mathematics or the particular topic under consideration will not be useful for the target student.
stereotyping - positive	Teacher comment to a target student saying that mathematics is equally appropriate for males and females, that mathematics ought to be free of sex stereotyping or that females are better at mathematics than are males.

stereotyping - negative	Teacher comments to a target student that mathematics is not appropriate as a subject of study for females, or that males are more suited to the study of mathematics than are females.
enjoyment - positive	Teacher states that the target student enjoys or likes mathematics.
enjoyment - negative	Teacher states that the target student dislikes mathmatics or does not enjoy some aspect of mathematics.
enjoyment - neutral	Teacher comments that a target student neither likes nor dislikes math.
expectations - positive	Teacher tells a target student that he/she will probably do well in mathematics or school.
expectations - negative	Teacher tells a target student that she/he will probably not be very successful in mathematics or school.
attribution	Teacher attributes a target student's success or failure in mathematics to ability, effort, the difficulty of the task, or the learning environment.

Non-Public Teacher-Student Contacts

student-created	This is a private contact between student and teacher that is initiated by the target student.
teacher-afforded	This is a private contact between the target student and the teacher which is initiated by the teacher.
work-related contact	This is a teacher student-teacher contact concerning the target student's seat work, homework, clarification of directions, or feedback about already completed work.
procedural contact	The target student requests permission to do something or requests information about how to take care of his/her own special needs. Or the teacher approaches a target student to ask him/her to run an errand, pass out equipment or otherwise help with class management. The contact

	whether teacher-afforded or student-created is to take care of a situation idiosyncratic to the target student involved.
behavioral contact	This is a teacher-initiated contact in which the teacher comments upon the target student's classroom behavior. The teacher singles out the target student for comment on his/her classroom behavior. The interaction is concerned with the target student's behavior and does not involve praise or criticism in connection with work-related or procedural contacts.

Time-Sampled Observation -- Quick Reference Outline

absent = A	Target student is absent during the observation period.
engaged = E	The target student is engaged in a learning activity related to mathematics content.
off-task = O	Off-task describes the target student when she/he is not engaged in a mathematics learning activity.
process = S	A process level of engagement requires the target student to integrate facts or show knowledge of interrelationships among facts.
product = T	A product level of engagement only requires that the target student know a specific fact.
spatial = SV	Spatial engagement is coded when the target student uses a figure or drawing to aid in solving a mathematics problem.
non-spatial = NS	Non-spatial engagement occurs when the target student is engaged in a mathematics learning activity but is not using a figure or drawing to aid in understanding the mathematics or solving the problem.
peer interaction = P	A target student is coded as interacting with a peer when she/he is working on some mathematical concept or problem with one or more peers.
no peer interaction = NP	The target student is engaged but not interacting with a peer or peers.

Appendix Two

54 114

I.D.		STUDENT 1											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

I.D.		STUDENT 2											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

I.D.		STUDENT 3											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

I.D.		STUDENT 4											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

I.D.		STUDENT 5											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

I.D.		STUDENT 6											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

I.D.		STUDENT 7											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

I.D.		STUDENT 8											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

I.D.		STUDENT 9											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

I.D.		STUDENT 10											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P		P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

I.D.		STUDENT 11											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

I.D.		STUDENT 12											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

I.D.		STUDENT 13											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8												
9	9												

ENGAGED TIME

OBSERVER		DAY		TEACHER	
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9

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IF FOUND, PLEASE RETURN TO: ELIZABETH FENNEMA, TEACHER EDUCATION BUILDING, UW—MADISON.

IF FOUND, PLEASE RETURN TO: ELIZABETH FENNEMA, TEACHER EDUCATION BUILDING, UW-MADISON

TEACHER – STUDENT INTERACTION

OBSERVER 0 0

DAY 0 0

TEACHER 0 0

STUDENT ID	STUDENT ID	STUDENT ID	STUDENT ID	STUDENT ID	STUDENT ID	STUDENT ID	STUDENT ID	STUDENT ID	STUDENT ID
1 1 0	1 2 1	1 3 2	1 4 3	1 5 4	1 6 5	1 7 6	7	8	9
absent ○	absent ○	absent ○	absent ●	absent ○	absent ○	absent ○	absent ○	absent ○	absent ○

STUDENT NUMBER **PUBLIC** **NON-PUBLIC**

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Appendix Three

TEACHER COMMENTS

Certain types of teacher comments which are directed to individual target students in public or in private are to be recorded. Some types of teacher comments are recorded on the Teacher-Student Interaction coding sheet, while other types of teacher comments are recorded on a separate sheet of paper with other observer remarks. Teacher comments may occur during other teacher-student interactions. The observer records teacher comments concerning: students' confidence in learning mathematics, the usefulness of mathematics, sex stereotyping of mathematics, student enjoyment or liking of mathematics, teacher expectations for student performance in mathematics or school, and teacher attributions of the causes of student success and failure. Only teacher attributions are coded on the Teacher-Student Interaction coding sheet. The other types of teacher comments are recorded on a separate sheet of paper.

Teacher Attributions

At times, teachers attribute the cause(s) of a target student's success or failure in mathematics to some perceived characteristic of the target student or her/his surroundings. For this observation, these causes are classified as: the target student's ability or lack of ability, effort or lack of effort on the part of the target student, the ease or difficulty of the task, or the enviornment of the classroom including the quality of teacher explanations. Attributions of causes of success for target students are separated from attributions of causes of failure. Eight categories of teacher attributions are coded on the Teacher-Student Interaction observation sheet. One column is provided on the coding sheet for each of the eight categories of teacher attributions. These columns are located between the PUBLIC and NON-PUBLIC sections.

A success-ability (S-A) attribution is coded when the teacher refers to ability as the reason for a target student's success. A success-effort (S-EF) attribution is coded when the teacher makes a reference to the amount of time, effort, or concentration a target student seems to have expended as the cause of that student's success. A success-task (S-T) attribution is coded when the teacher refers to the ease of the material of or the target student's familiarity with the material as the reason for the student's success. When the teacher makes reference to the positive classroom environment or the good job that was done in explaining as the cause of the target student's success, a success-environment (S-EN) attribution is coded.

When the teacher attributes a target student's failure to grasp an idea to a lack of ability or talent, a failure-ability (F-A) attribution is coded. A failure-effort (F-EF) attribution is coded when the teacher refers to a failure to spend sufficient time on a task, failure to concentrate on a task, or a lack of determination as the cause of a target student's failure to understand or learn a concept or idea. When the teacher attributes a target student's failure to learn something to the difficulty of the task, a failure-task (F-T) attribution is coded. At times, the teacher will attribute a target student's failure to the fact that the material was not explained well or that the learning environment was not a good one. Such attributions are coded as failure-environment (F-EN).

When a teacher attribution comment occurs as part of an interaction between a target student and the teacher, the attribution is coded in the same row as the student number and other description of the interaction. If the comment occurs outside of a normally coded interaction, the student's identification number should be darkened and the appropriate attribution circle darkened also.

When the types of teacher comments concerning confidence, usefulness, stereotyping, enjoyment, and expectations occur, the comment should be recorded on another piece of paper with other observer remarks. Be sure to record the comment and the student's identification number. These non-attribution comments are described below.

Confidence

Comments concerning a target student's confidence in mathematics are classified as positive, negative, or neither positive nor negative (+, -, N). A positive comment about a target student's mathematical confidence gives some indication that the teacher perceives the student as confident in his/her ability to learn mathematics. When the teacher states that she/he feels a target student is low in confidence concerning her/his ability to learn mathematics (or anxious about mathematics) a negative comment is coded. A comment about student confidence that falls in neither of these categories is coded as N (neither).

Usefulness

Usefulness comments by the teacher which are directed to an individual target student are coded positive or negative (+, -). A comment classified as positive is one which indicates that mathematics in general or some specific mathematical topic will be useful to the target student. A comment concerning the usefulness of mathematics is considered negative if it indicates that mathematics or the specific topic under consideration will not be useful for the target student.

Stereotyping

At times, teachers comment about the appropriateness of studying mathematics for males or females. A positive stereotyping comment is one which is directed to a target student and which indicates that mathematics is equally appropriate for females and males or which says that mathematics ought to be free of sex stereotyping. A comment to a target student which says that females are better at math than males is also considered a positive stereotyping comment in favor of females. A negative stereotyping comment gives the idea that math is not an appropriate subject for a female student to excel in or that males are more suited to the study of mathematics than females. A teacher comment indicating that girls and boys are equally capable in mathematics should be recorded also, as a non-stereotyping comment.

Enjoyment

A positive comment by the teacher is one which gives the indication that the target student likes mathematics or enjoys doing some aspect of mathematics. A comment stating that a target student dislikes mathematics or does not enjoy doing some specific mathematical work is coded as negative. When the teacher comments that a target student neither likes nor dislikes mathematics, an N (neither) is coded.

Expectations

When a teacher tells a target student that she/he will probably do well in mathematics or be successful in school, a positive expectation comment is coded. A negative expectation comment is coded when a target student is told that he/she probably will not be very successful in mathematics or in school.

Appendix B

Data Sheets

FOUND PLEASE RETURN TO: ELIZABETH FENNEMA, TEACHER EDUCATION BUILDING, UW-MADISON

TEACHER – STUDENT INTERACTION

OBSERVER ⓪①②③④⑤⑥⑦⑧⑨ ⓪①②③④⑤⑥⑦⑧⑨

DAY ⓪①②③④⑤⑥⑦⑧⑨ ⓪①②③④⑤⑥⑦⑧⑨

TEACHER ⓪①②③④⑤⑥⑦⑧⑨ ⓪①②③④⑤⑥⑦⑧⑨

STUDENT I.D.	STUDENT I.D.	STUDENT I.D.	STUDENT I.D.	STUDENT I.D.	STUDENT I.D.	STUDENT I.D.	STUDENT I.D.	STUDENT I.D.	STUDENT I.D.
0	1	2	3	4	5	6	7	8	9
⓪⓪⓪	⓪⓪⓪	⓪⓪⓪	⓪⓪⓪	⓪⓪⓪	⓪⓪⓪	⓪⓪⓪	⓪⓪⓪	⓪⓪⓪	⓪⓪⓪
①①①	①①①	①①①	①①①	①①①	①①①	①①①	①①①	①①①	①①①
②②②	②②②	②②②	②②②	②②②	②②②	②②②	②②②	②②②	②②②
③③③	③③③	③③③	③③③	③③③	③③③	③③③	③③③	③③③	③③③
④④④	④④④	④④④	④④④	④④④	④④④	④④④	④④④	④④④	④④④
⑤⑤⑤	⑤⑤⑤	⑤⑤⑤	⑤⑤⑤	⑤⑤⑤	⑤⑤⑤	⑤⑤⑤	⑤⑤⑤	⑤⑤⑤	⑤⑤⑤
⑥⑥⑥	⑥⑥⑥	⑥⑥⑥	⑥⑥⑥	⑥⑥⑥	⑥⑥⑥	⑥⑥⑥	⑥⑥⑥	⑥⑥⑥	⑥⑥⑥
⑦⑦⑦	⑦⑦⑦	⑦⑦⑦	⑦⑦⑦	⑦⑦⑦	⑦⑦⑦	⑦⑦⑦	⑦⑦⑦	⑦⑦⑦	⑦⑦⑦
⑧⑧⑧	⑧⑧⑧	⑧⑧⑧	⑧⑧⑧	⑧⑧⑧	⑧⑧⑧	⑧⑧⑧	⑧⑧⑧	⑧⑧⑧	⑧⑧⑧
⑨⑨⑨	⑨⑨⑨	⑨⑨⑨	⑨⑨⑨	⑨⑨⑨	⑨⑨⑨	⑨⑨⑨	⑨⑨⑨	⑨⑨⑨	⑨⑨⑨
absent ○	absent ○	absent ○	absent ○	absent ○	absent ○	absent ○	absent ○	absent ○	absent ○

STUDENT NUMBER	PUBLIC		NON-PUBLIC
⓪①②③④⑤⑥⑦⑧⑨	○○○○ ○○○○ ○○○○ ①②③ ①②③ ①②③ ①②③	○○○○ ○○○○	○○○○○ ○○○ ○○○○○ ○ ○○○

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I.D.		STUDENT 1											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

I.D.		STUDENT 2											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

I.D.		STUDENT 3											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

I.D.		STUDENT 4											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

I.D.		STUDENT 5											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

I.D.		STUDENT 6											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

I.D.		STUDENT 7											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

I.D.		STUDENT 8											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

I.D.		STUDENT 9											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

I.D.		STUDENT 10											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

I.D.		STUDENT 11											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
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2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

I.D.		STUDENT 12											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

I.D.		STUDENT 13											
		A	A	A	A	A	A	A	A	A	A	A	A
0	0	E	E	E	E	E	E	E	E	E	E	E	E
1	1	O	O	O	O	O	O	O	O	O	O	O	O
2	2	S	S	S	S	S	S	S	S	S	S	S	S
3	3	T	T	T	T	T	T	T	T	T	T	T	T
4	4	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV	SV
5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
6	6	P	P	P	P	P	P	P	P	P	P	P	P
7	7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	8	○	○	○	○	○	○	○	○	○	○	○	○
9	9	○	○	○	○	○	○	○	○	○	○	○	○

ENGAGED

TIME

OBSERVER		DAY		TEACHER	
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9

○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○
○	○	○	○	○	○

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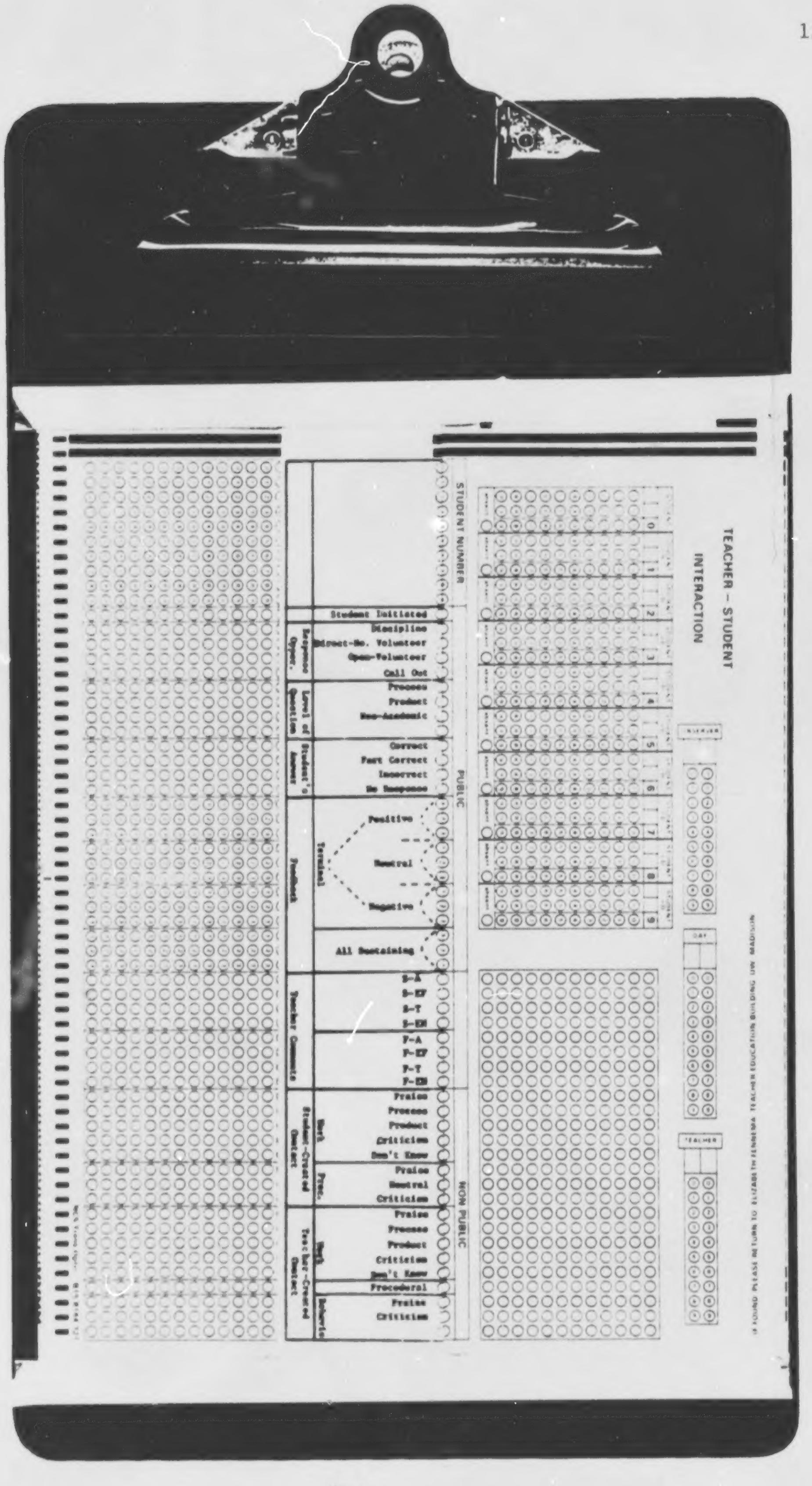
IF FOUND, PLEASE RETURN TO: ELIZABETH FENNEMA, TEACHER EDUCATION BUILDING, UW—MADISON.



TEACHER – STUDENT INTERACTION

STUDENT NUMBER

OBSERVER

DAY

TEACHER

PUBLIC

NON PUBLIC

Student Initiated

Response Oppor.
- Discipline
- Direct-No. Volunteer
- Open-Volunteer
- Call Out

Level of Question
- Process
- Product
- Non-Academic

Student's Answer
- Correct
- Part Correct
- Incorrect
- No Response

Feedback
- Terminal
  - Positive
  - Neutral
  - Negative
- All Sustaining

Teacher Comments
- S-A
- S-EF
- S-T
- S-EN
- F-A
- F-EF
- F-T
- F-EN

Student-Created Contact
- Work
  - Praise
  - Process
  - Product
  - Criticism
  - Don't Know
- Proc.
  - Praise
  - Neutral
  - Criticism

Teacher-Created Contact
- Work
  - Praise
  - Process
  - Product
  - Criticism
  - Don't Know
- Procedural
- Behavior
  - Praise
  - Criticism

IF FOUND PLEASE RETURN TO ELIZABETH FENNEMA TEACHER EDUCATION BUILDING UW MADISON

Appendix C

Observer Agreement

Observer Agreement - Year I

Teacher-Student Interaction Observation Categories

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Identification of Interaction	1	$\frac{48}{50}$	96%
	2	$\frac{60}{65}$	92%
	3	$\frac{52}{55}$	95%
	4	$\frac{22}{25}$	88%
	All	$\frac{182}{195}$	93%
	Public Interactions		
Initiator	1	$\frac{43}{44}$	98%
	2	$\frac{34}{34}$	100%
	3	$\frac{30}{31}$	97%
	4	$\frac{12}{13}$	92%
	All	$\frac{119}{122}$	98%
Response Opportunity	1	$\frac{42}{44}$	95%
	2	$\frac{27}{34}$	79%
	3	$\frac{25}{31}$	81%
	4	$\frac{8}{9}$	89%
	All	$\frac{102}{118}$	86%

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Level of Question	1	$\frac{37}{44}$	84%
	2	$\frac{33}{34}$	97%
	3	$\frac{24}{31}$	77%
	4	$\frac{9}{9}$	100%
	All	$\frac{103}{118}$	87%
Student Answer	1	$\frac{44}{48}$	92%
	2	$\frac{28}{34}$	82%
	3	$\frac{28}{31}$	90%
	4	$\frac{9}{9}$	100%
	All	$\frac{109}{122}$	89%
Positive Feedback	1	$\frac{38}{48}$	79%
	2	$\frac{30}{34}$	88%
	3	$\frac{26}{31}$	84%
	4	$\frac{8}{9}$	89%
	All	$\frac{102}{122}$	84%

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Neutral Feedback	1	$\frac{38}{47}$	81%
	2	$\frac{27}{34}$	79%
	3	$\frac{25}{31}$	81%
	4	$\frac{8}{9}$	89%
	All	$\frac{98}{121}$	81%
Negative Feedback	1	$\frac{44}{46}$	96%
	2	$\frac{33}{34}$	97%
	3	$\frac{30}{31}$	97%
	4	$\frac{9}{9}$	100%
	All	$\frac{116}{120}$	97%
Sustaining Feedback	1	$\frac{45}{47}$	96%
	2	$\frac{32}{34}$	94%
	3	$\frac{30}{31}$	97%
	4	$\frac{7}{9}$	78%
	All	$\frac{114}{121}$	94%

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
		Private Interactions	
Student-Initiated Work Lower Level	1	$\frac{2}{3}$	67%
	2	$\frac{5}{9}$	56%
	3	$\frac{2}{3}$	67%
	4	$\frac{4}{4}$	100%
	All	$\frac{13}{19}$	68%
Higher Level	1	$\frac{1}{1}$	100%
	2	$\frac{2}{2}$	100%
	3	none	
	4	$\frac{1}{1}$	100%
	All	$\frac{4^*}{4}$	
Criticism	1	none	
	2	none	
	3	none	
	4	$\frac{1}{1}$	100%
	All	$\frac{1^*}{1}$	

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Praise	1	none	
	2	none	
	3	none	
	4	none	
	All	none*	
Don't Know	1	none	
	2	none	
	3	none	
	4	none	
	All	none*	
Teacher-Initiated Work			
Lower Level	1	none	
	2	$\frac{2}{4}$	50%
	3	$\frac{7}{8}$	88%
	4	$\frac{1}{1}$	100%
	All	$\frac{10}{13}$	77%
Higher Level	1	none	
	2	$\frac{1}{2}$	50%
	3	none	
	4	none	
	All	$\frac{1}{2}$*	

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Teacher-Initiated Work			
Praise	1	none	
	2	none	
	3	none	
	4	$\frac{1}{1}$	100%
	All	$\frac{1}{1}$*	
Criticism	1	none	
	2	none	
	3	none	
	4	$\frac{2}{2}$	100%
	All	$\frac{2}{2}$*	
Don't Know	1	none	
	2	none	
	3	none	
	4	none	
	All	none*	
Student-Initiated Procedural			
Praise	1	none	
	2	none	
	3	none	
	4	none	
	All	none*	

Table 4 (Continued)

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Neutral	1	none	
	2	$\frac{0}{4}$	0%
	3	$\frac{2}{2}$	100%
	4	$\frac{4}{4}$	100%
	All	$\frac{6}{10}$	60%
Criticism	1	none	
	2	$\frac{0}{1}$	0%
	3	none	
	4	none	
	All	$\frac{0}{1}$*	
Teacher-Initiated Procedural Neutral	1	none	
	2	none	
	3	$\frac{2}{3}$	67%
	4	none	
	All	$\frac{2}{3}$*	
Public or Private Interactions			
Behavioral Praise	1	none	
	2	none	
	3	none	
	4	none	
	All	none*	

Table 4 (Continued)

Category	Observer	Agreements / Agreements + Disagreements	Percent Agreement
Criticism	1	none	
	2	$\frac{2}{4}$	50%
	3	$\frac{5}{5}$	100%
	4	none	
	All	$\frac{7}{9}$	78%

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*Fewer than 5 occurrences during agreement checks make percents unstable.

Observer Agreement - Year I

Engaged Time Observation Categories

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Engagement	5	$\frac{58}{60}$	97%
	6	$\frac{238}{270}$	88%
	7	$\frac{53}{59}$	90%
	8	$\frac{174}{197}$	88%
	9	$\frac{20}{36}$	56%
	10	$\frac{133}{172}$	77%
	All	$\frac{676}{794}$*	85%
Cognitive Level	5	$\frac{21}{25}$	84%
	6	$\frac{170}{175}$	97%
	7	$\frac{20}{26}$	77%
	8	$\frac{106}{118}$	90%
	9	$\frac{13}{14}$	93%
	10	$\frac{82}{108}$	76%
	All	$\frac{412}{466}$	88%

*The denominator is the number of cycles observed for which the category was appropriate.

Observer Agreement - Year II

Engaged Time Observation Categories

Category	Observer	Agreements / Agreements + Disagreements	Percent Agreement
Engagement	4	127/130	98%
	6	91/98	93%
	11	36/41	88%
	14	98/105	93%
	All	352/374	94%
Cognitive Level	4	66/70	94%
	6	56/57	98%
	11	31/31	100%
	14	63/70	90%
	All	216/228	95%
Spatial	4	69/70	99%
	6	50/57	88%
	11	26/31	84%
	14	70/70	100%
	All	215/228	94%

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Peer Interaction	4	$\frac{64}{70}$	91%
	6	$\frac{56}{57}$	98%
	11	$\frac{31}{31}$	100%
	14	$\frac{68}{70}$	97%
	All	$\frac{219}{228}$	96%

Observer Agreement - Year II

Teacher-Student Interaction Observation Categories

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Identification of Interaction	2	$\frac{20}{23}$	87%
	5	$\frac{4}{4}$	100%
	7	$\frac{70}{73}$	96%
	8	$\frac{28}{29}$	97%
	11	$\frac{38}{45}$	84%
	All	$\frac{160}{174}$	92%
		Public Interactions	
Initiator	2	$\frac{3}{4}$	75%
	5	*	*
	7	$\frac{33}{34}$	97%
	8	$\frac{11}{11}$	100%
	11	$\frac{14}{14}$	100%
	All	$\frac{61}{63}$	97%

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Response Opportunity	2	$\frac{3}{4}$	75%
	5	*	*
	7	$\frac{27}{34}$	79%
	8	$\frac{10}{11}$	91%
	11	$\frac{13}{14}$	93%
	All	$\frac{53}{63}$	84%
Level of Question	2	$\frac{2}{4}$	50%
	5	*	*
	7	$\frac{26}{34}$	76%
	8	$\frac{6}{11}$	55%
	11	$\frac{14}{14}$	100%
	All	$\frac{48}{63}$	76%
Student Answer	2	$\frac{3}{4}$	75%
	5	*	*
	7	$\frac{32}{34}$	94%
	8	$\frac{11}{11}$	100%
	11	$\frac{14}{14}$	100%
	All	$\frac{60}{63}$	95%

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Positive Feedback	5	*	*
	7	$\frac{34}{34}$	100%
	8	$\frac{10}{11}$	91%
	11	$\frac{12}{14}$	86%
	All	$\frac{59}{63}$	94%
Neutral Feedback	2	$\frac{4}{4}$	100%
	5	*	*
	7	$\frac{20}{34}$	59%
	8	$\frac{10}{11}$	91%
	11	$\frac{13}{14}$	93%
	All	$\frac{47}{63}$	75%
Negative Feedback	2	$\frac{3}{4}$	75%
	5	*	*
	7	$\frac{32}{34}$	94%
	8	$\frac{11}{11}$	100%
	11	$\frac{12}{14}$	86%
	All	$\frac{58}{63}$	92%

Category	Observer	Agreements / Agreements + Disagreements	Percent Agreement
Sustaining Feedback	5	*	*
	7	$\frac{33}{34}$	97%
	8	$\frac{11}{11}$	100%
	11	$\frac{11}{14}$	79%
	All	$\frac{59}{63}$	94%
Private Interactions			
Student-Initiated Work Higher Level	2		
	5		
	7	$\frac{3}{3}$	100%
	8		
	11	$\frac{3}{4}$	75%
	All	$\frac{6}{7}$	86%
Lower Level	2	$\frac{2}{4}$	50%
	5	$\frac{3}{3}$	100%
	7	$\frac{15}{19}$	79%
	8	$\frac{8}{8}$	100%
	11	$\frac{11}{12}$	92%
	All	$\frac{39}{46}$	85%

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Criticism	2	0	
	5	0	
	7	$\frac{1}{1}$	100%
	8	0	
	11	0	
	All	$\frac{1}{1}$	100%
Student-Initiated Work Praise	2		
	5		
	7		
	8	none	
	11		
Neutral	2	$\frac{1}{2}$	50%
	5	$\frac{1}{1}$	100%
	7	$\frac{2}{6}$	33%
	8	$\frac{2}{4}$	50%
	11	$\frac{2}{3}$	67%
	All	$\frac{8}{16}$	50%
Don't Know	2	0	
	5	0	
	7	0	
	8	$\frac{1}{1}$	100%
	11	$\frac{0}{1}$	0%
	All	$\frac{1}{2}$	50%

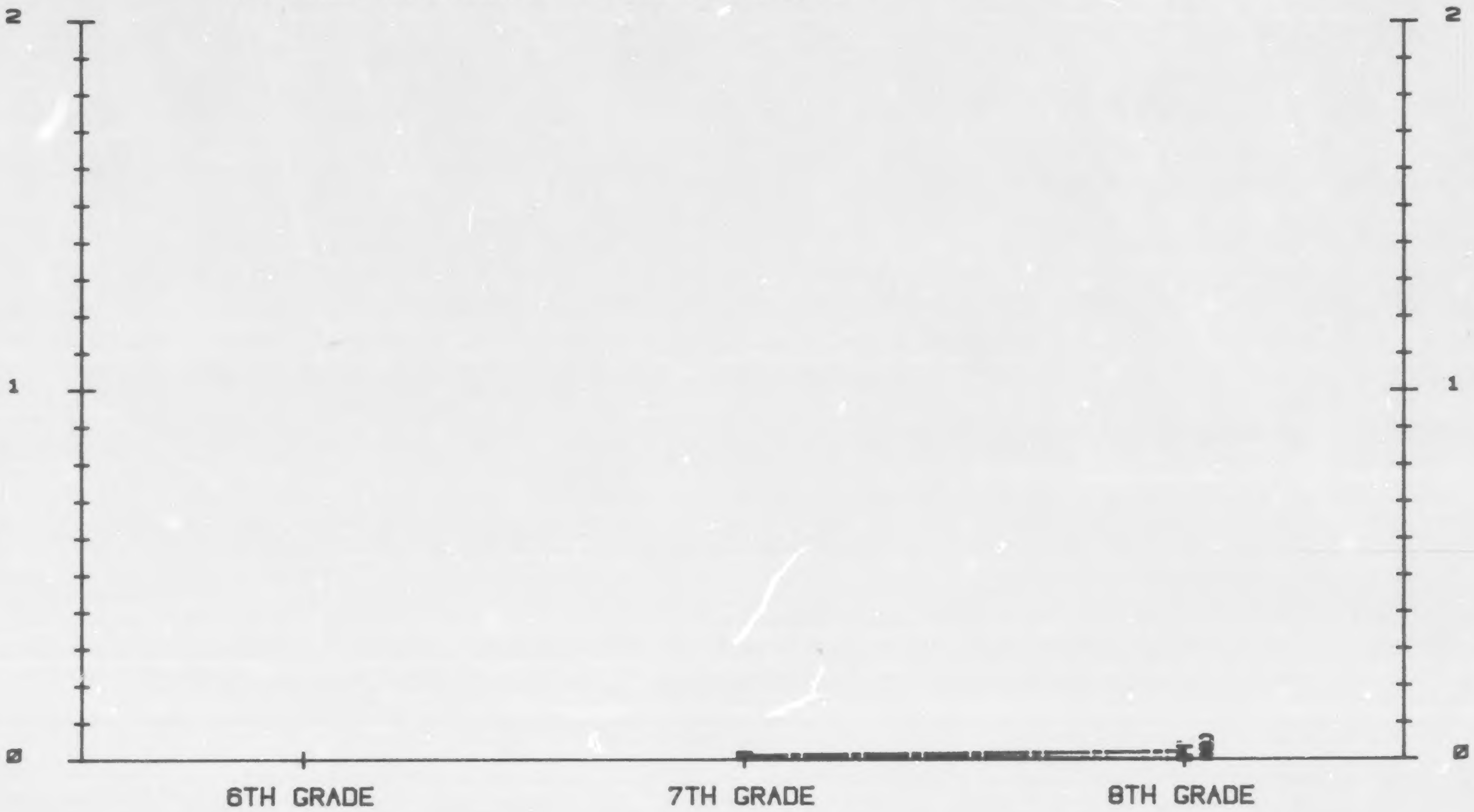
Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Teacher-Initiated Work Praise	2		
	5		
	7	$\frac{1}{1}$	100%
	8		
	11		
	All	$\frac{1}{1}$	100%
Lower Level	2	$\frac{0}{1}$	0%
	5	0	
	7	$\frac{2}{3}$	67%
	8	$\frac{1}{1}$	100%
	11	$\frac{1}{1}$	100%
	All	$\frac{4}{6}$	67%
Teacher-Initiated Procedural	2	$\frac{1}{1}$	
	5	0	
	7	$\frac{2}{2}$	
	8	$\frac{1}{1}$	
	11	$\frac{1}{1}$	
	All	$\frac{5}{5}$	100%

Category	Observer	$\frac{\text{Agreements}}{\text{Agreements + Disagreements}}$	Percent Agreement
Behavioral Criticism	2	$\frac{3}{3}$	
	5	0	
	7	$\frac{4}{5}$	
	8	$\frac{1}{1}$	
	11	$\frac{1}{1}$	
	All	$\frac{9}{10}$	90%

Appendix D

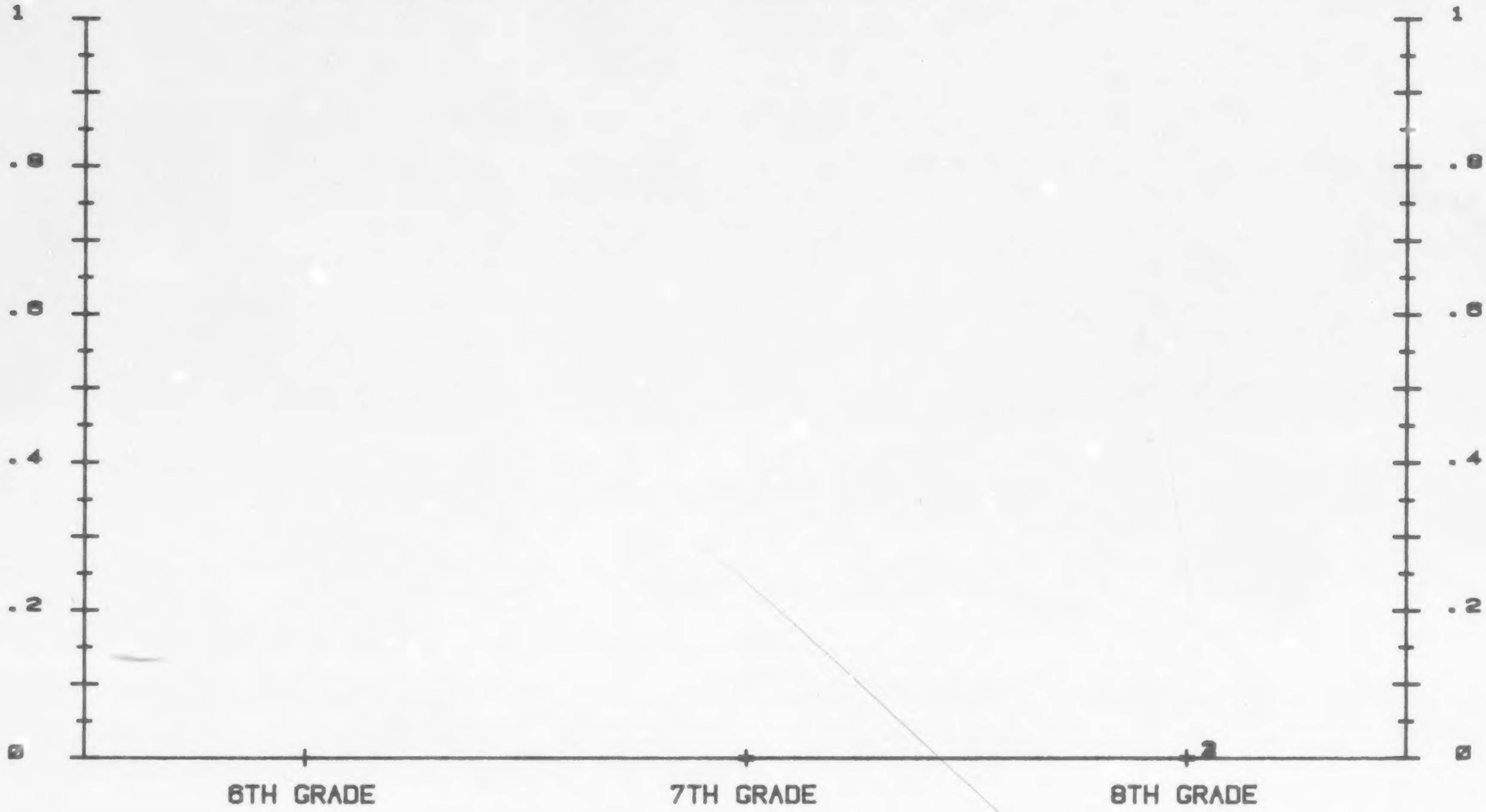
Teacher-Pupil Interactions: Two Year Plots

RESPONSE OPPORTUNITY - DISCIPLINE MF/D



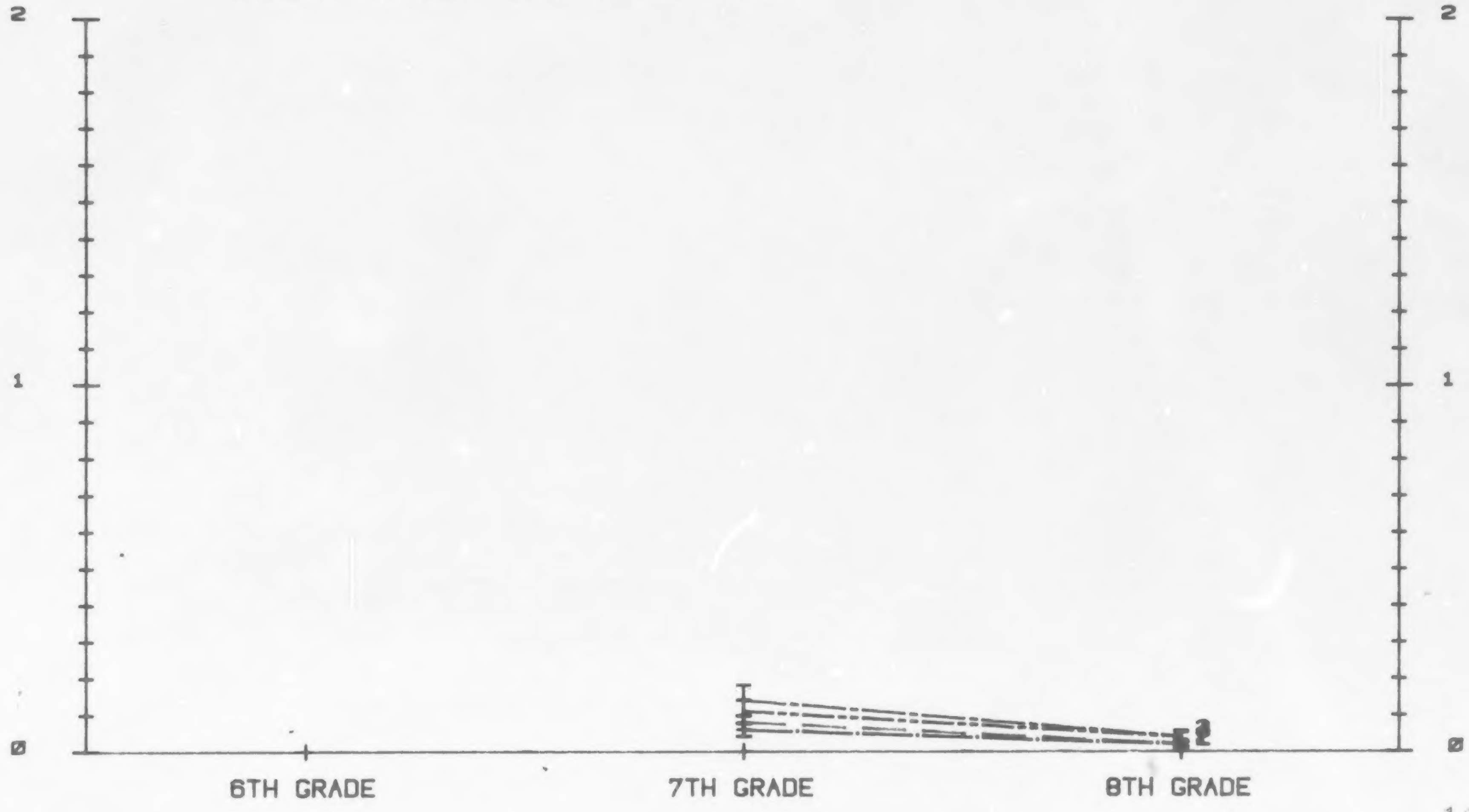
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.01	0.00
2	—·—·—	FEMALE LOW CONF	*	0.00	0.00
3	—··—··—	MALE HIGH CONF	*	.01	.02
4	-·-·-·-·-	MALE LOW CONF	*	.01	0.00

TEACHER INITIATED BEHAVIORAL - PRAISE MF/D



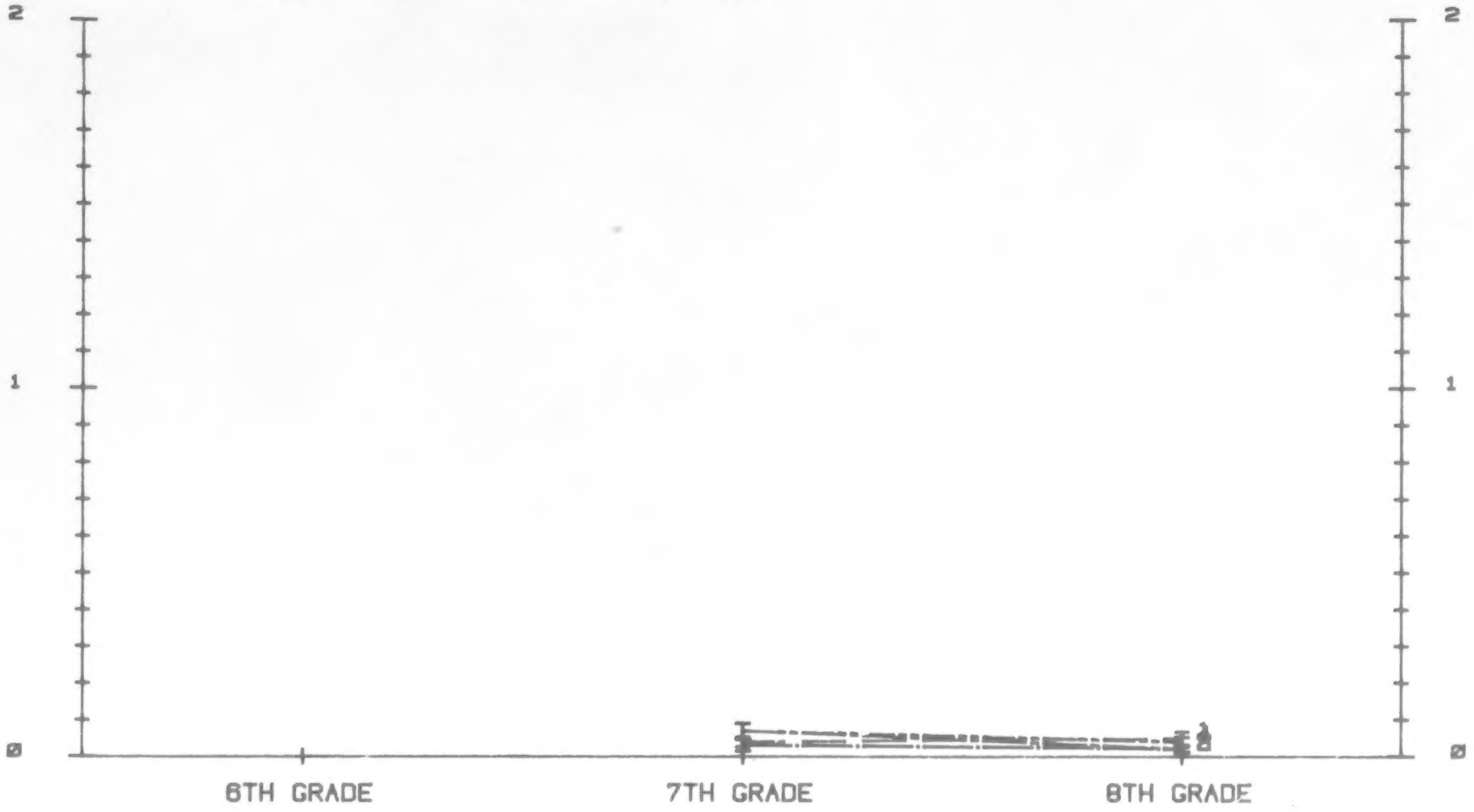
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	—· — — —	FEMALE HIGH CONF	*	0.00	0.00
2	——·——·—	FEMALE LOW CONF	*	0.00	0.00
3	—·—·—·—	MALE HIGH CONF	*	0.00	0.00
4	-·-·-·-·-·-	MALE LOW CONF	*	0.00	0.00

STUDENT ANSWER - PART CORRECT MF/D



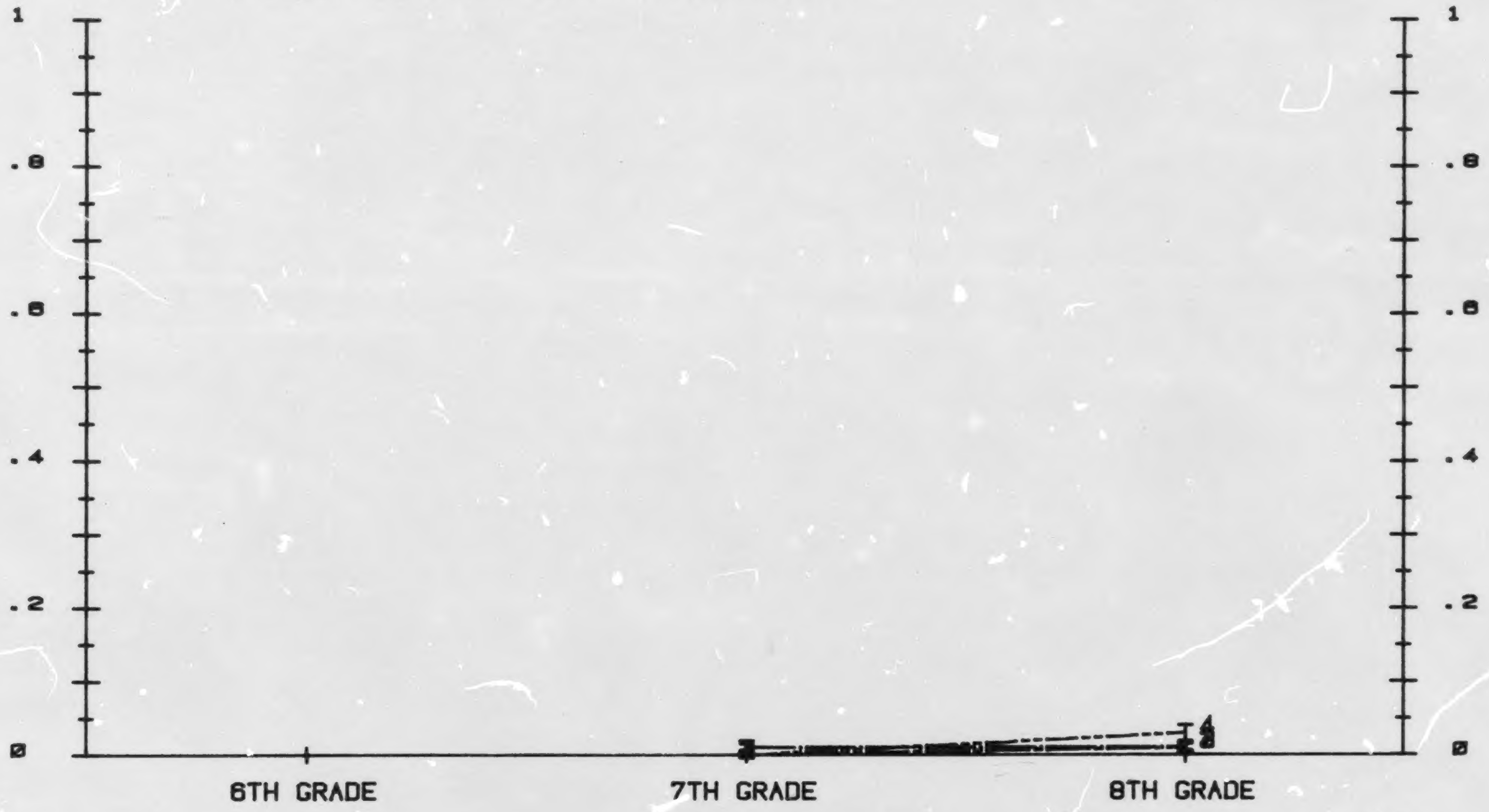
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.08	.02
2	—·—·—	FEMALE LOW CONF	*	.06	.02
3	—·—·—	MALE HIGH CONF	*	.14	.04
4	-·-·-·-	MALE LOW CONF	*	.11	.04

STUDENT ANSWER - NO RESPONSE MF/D



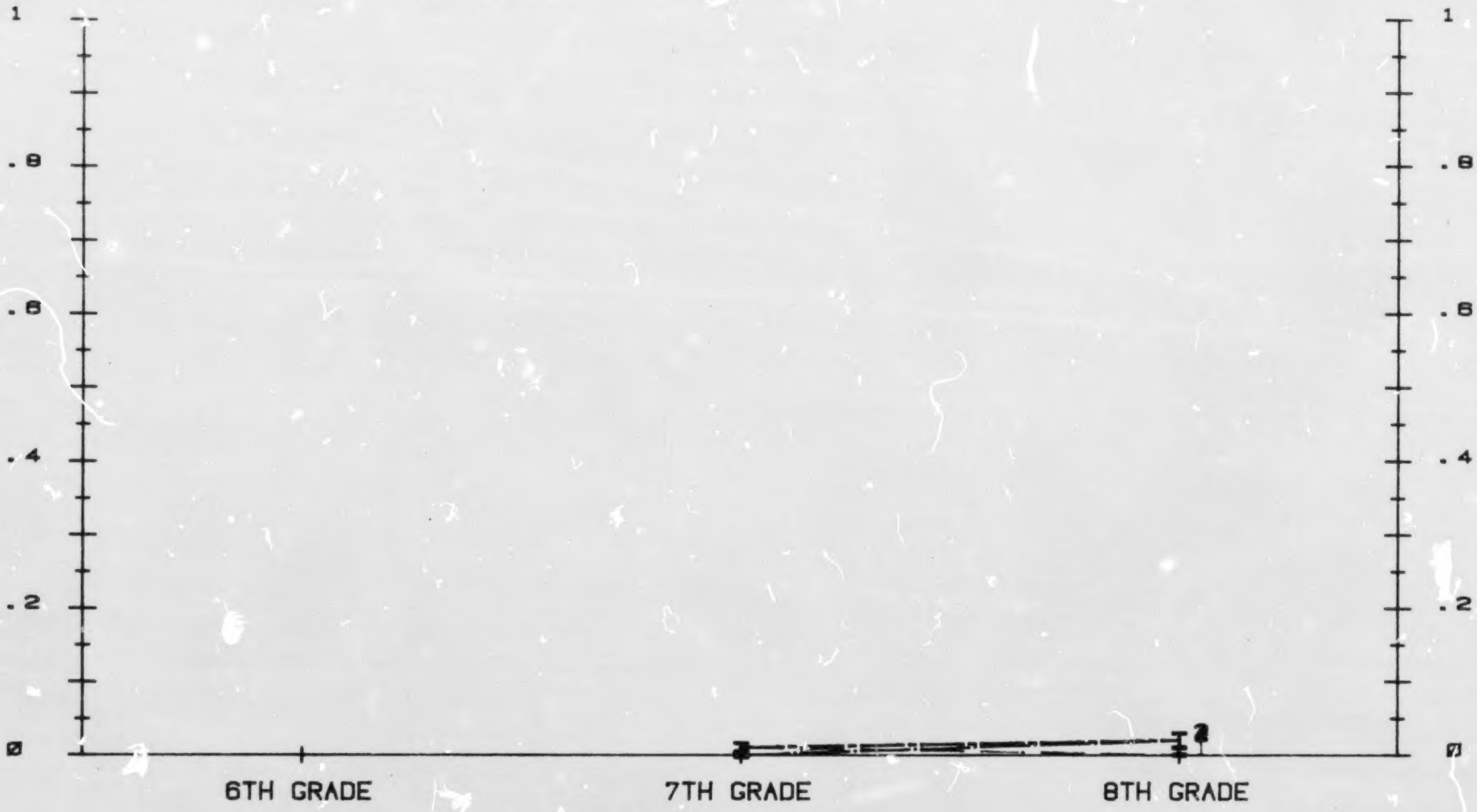
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.04	.05
2	——·——	FEMALE LOW CONF	*	.03	.02
3	——·—·——	MALE HIGH CONF	*	.07	.02
4	—·-·-·-·-	MALE LOW CONF	*	.07	.04

STUDENT INITIATED WORK - PRAISE MF/D



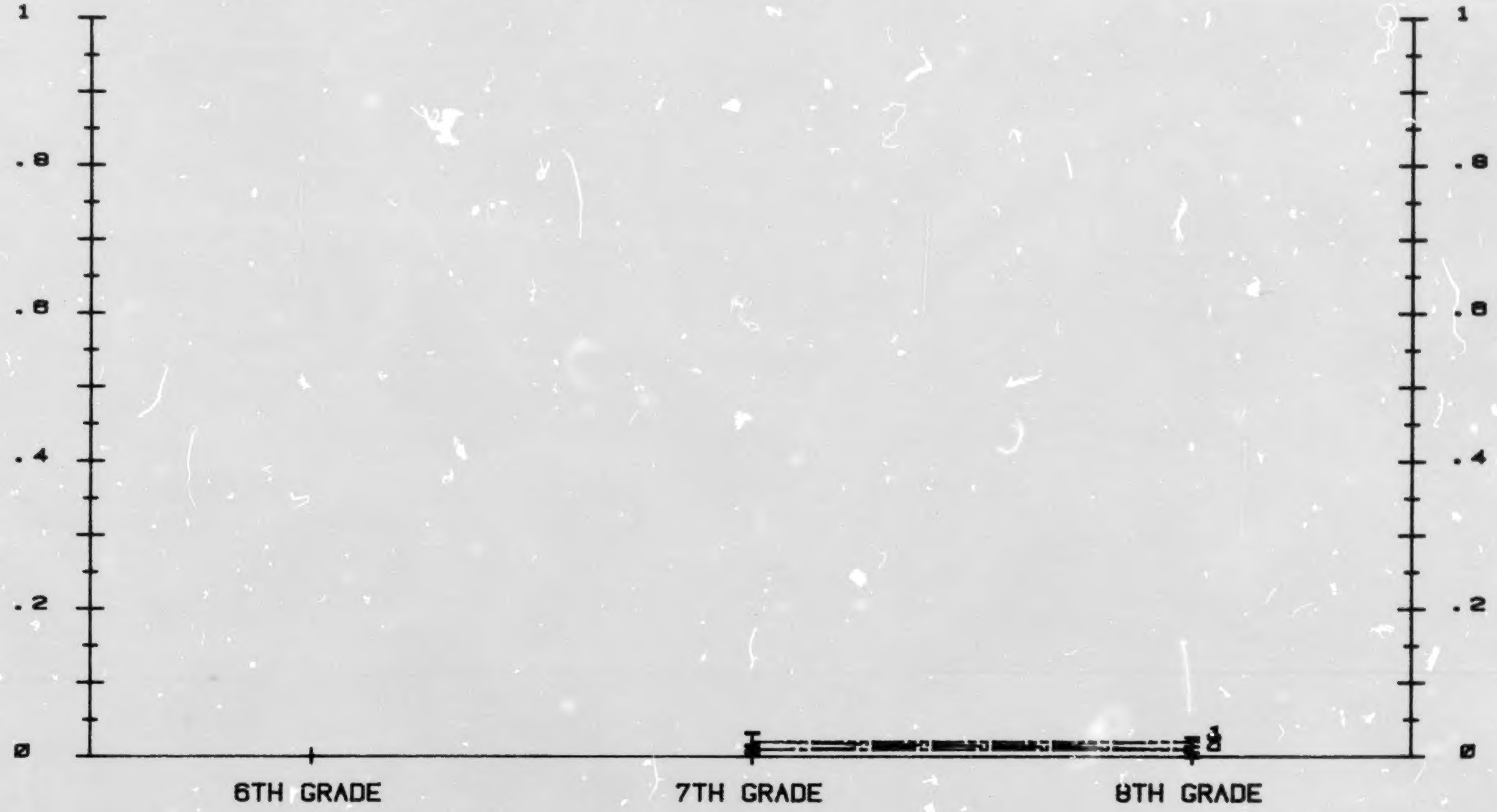
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — — —	FEMALE HIGH CONF	*	.01	.01
2	——·——·——	FEMALE LOW CONF	*	.01	.01
3	——·—·——·—	MALE HIGH CONF	*	0.00	.01
4	-·-·-·-·-·-	MALE LOW CONF	*	0.00	.03

STUDENT INITIATED WORK - CRITICISM MF/D



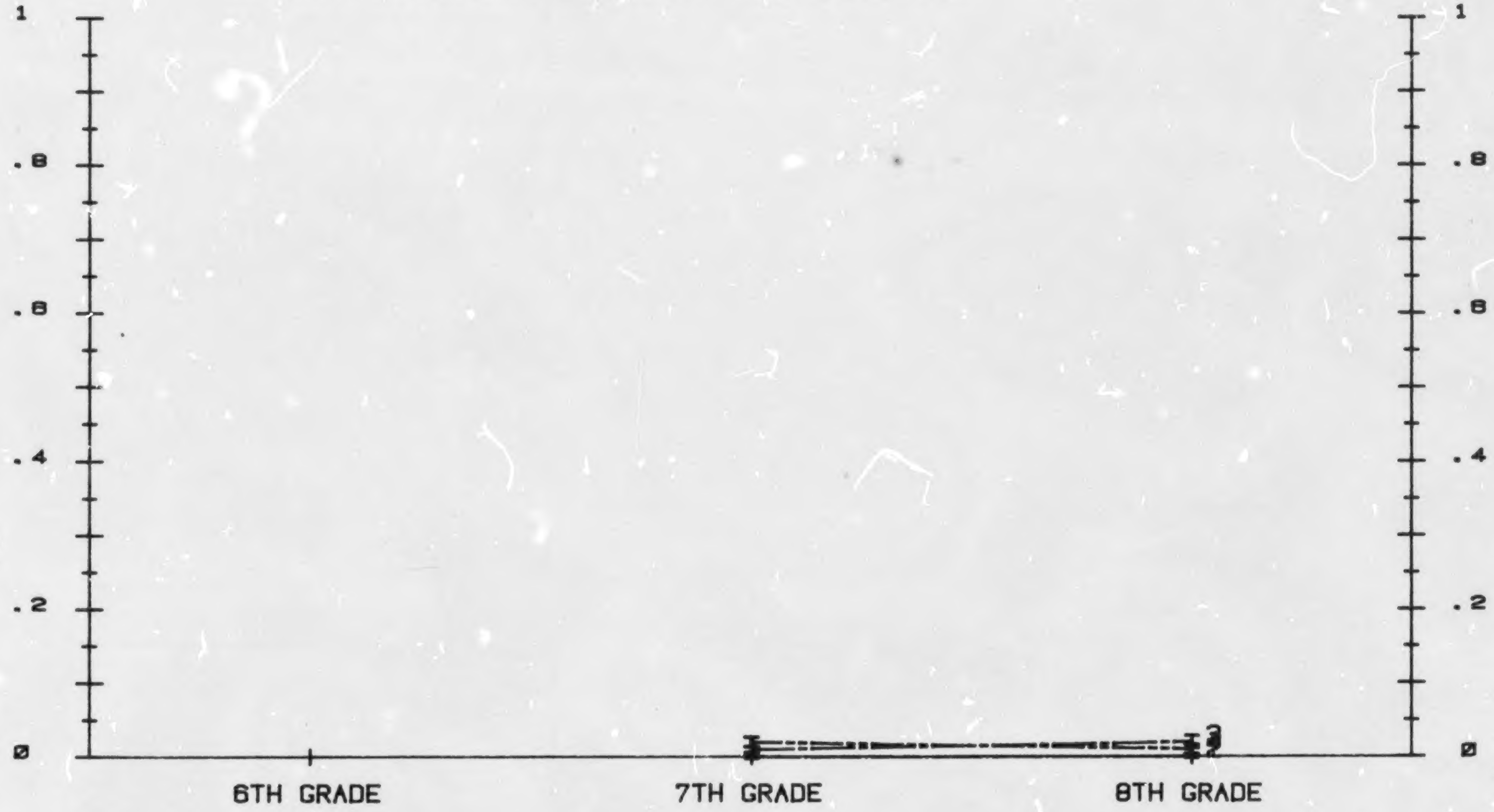
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — — —	FEMALE HIGH CONF	*	.01	0.00
2	——-——	FEMALE LOW CONF	*	0.00	.02
3	—-—-—	MALE HIGH CONF	*	.01	.02
4	--------	MALE LOW CONF	*	.01	.02

TEACHER INITIATED WORK - PRAISE MF/D



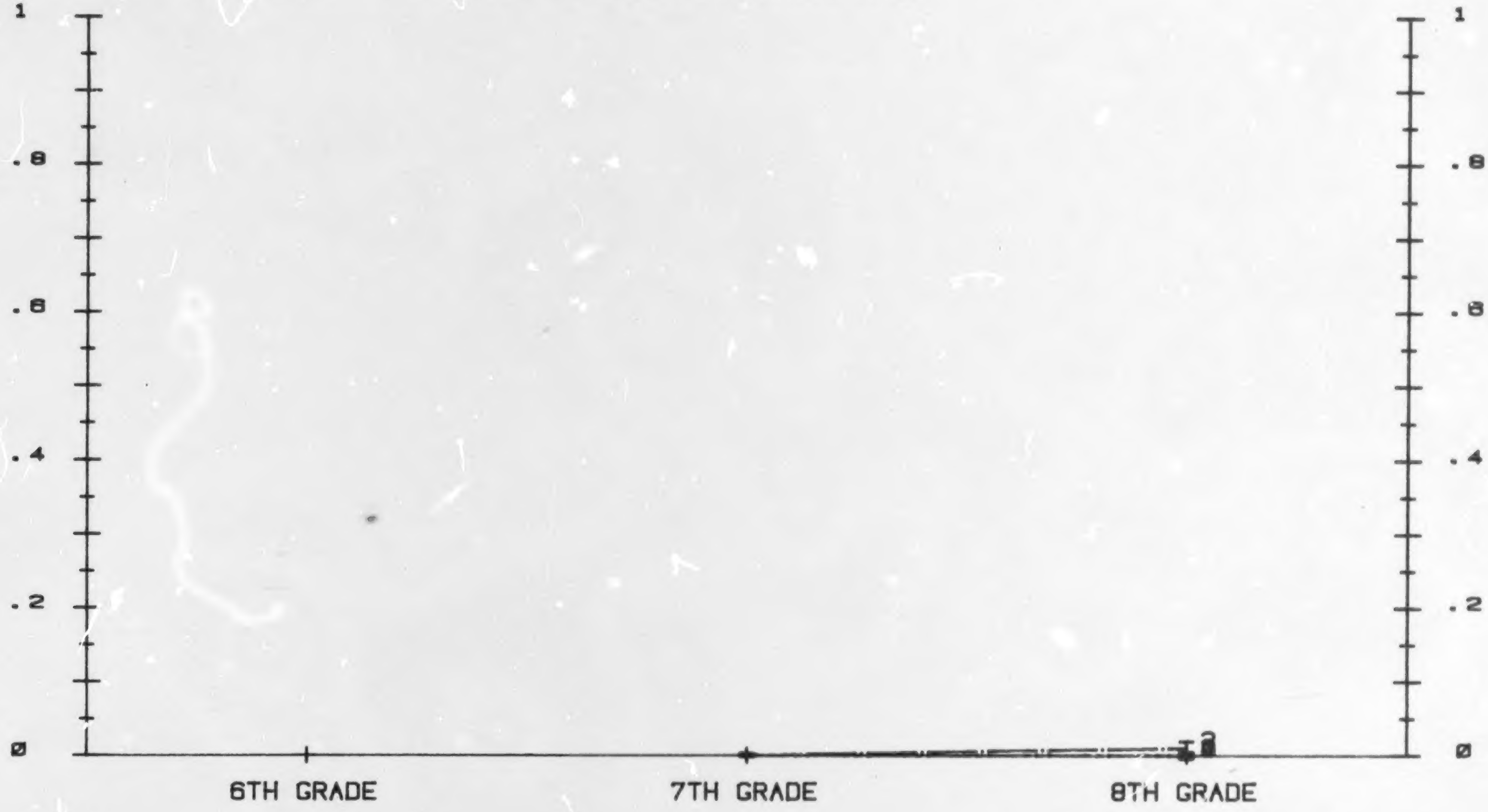
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.01	.02
2	———·——	FEMALE LOW CONF	*	.02	.01
3	——·——·——	MALE HIGH CONF	*	.01	.01
4	-·-·-·-·-·-	MALE LOW CONF	*	.02	.02

STUDENT INITIATED PROCEDURAL - CRITICISM MF/D



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	--- --- ---	FEMALE HIGH CONF	*	0.00	0.00
2	————·————	FEMALE LOW CONF	*	0.00	0.00
3	———-·-———	MALE HIGH CONF	*	.01	.02
4	--------·--	MALE LOW CONF	*	.02	.01

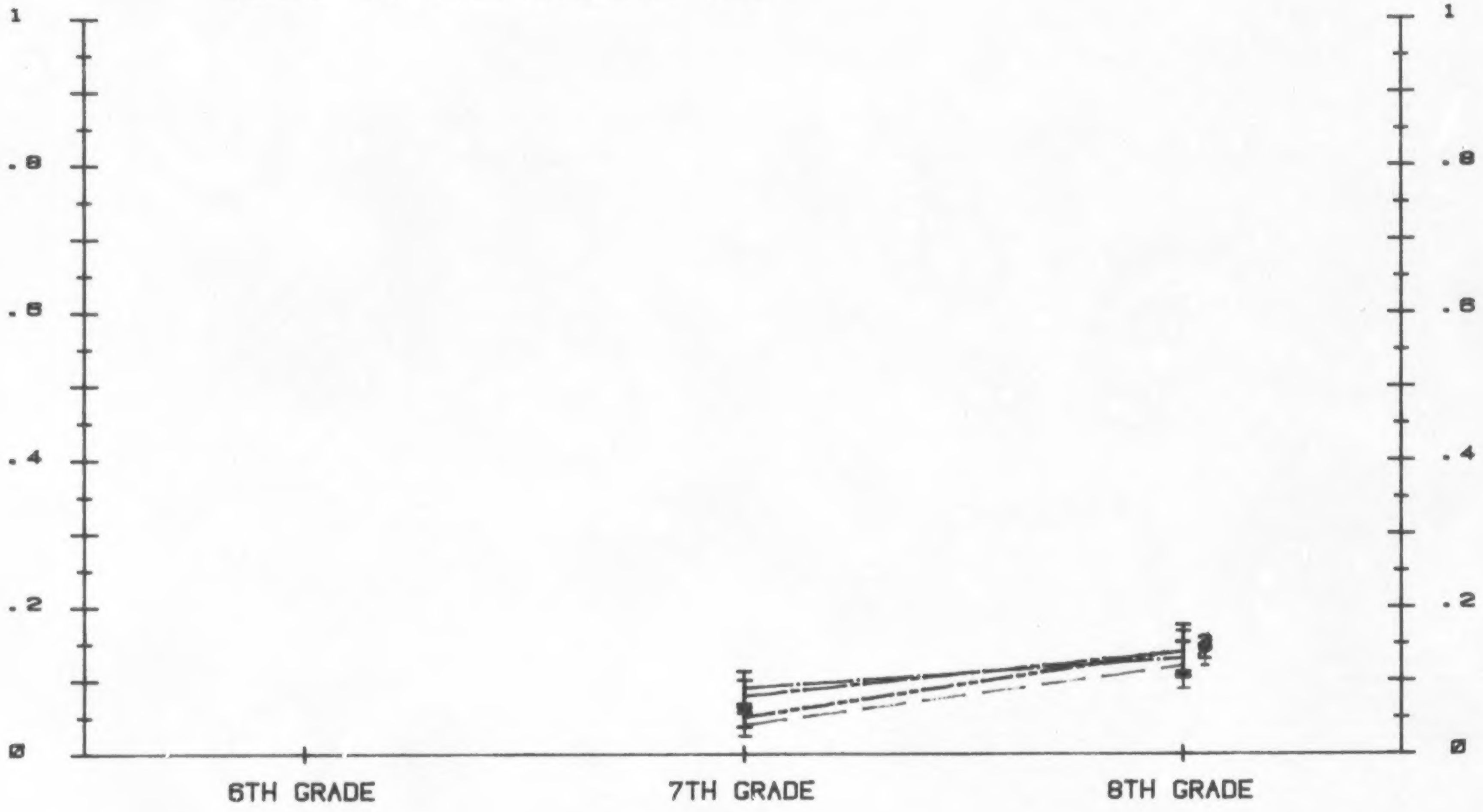
STUDENT INITIATED PROCEDURAL - PRAISE MF/D



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — — —	FEMALE HIGH CONF	*	0.00	0.00
2	——·——·——	FEMALE LOW CONF	*	0.00	.01
3	—·—·—·—	MALE HIGH CONF	*	0.00	0.00
4	—·-·-·-·-	MALE LOW CONF	*	0.00	0.00

197

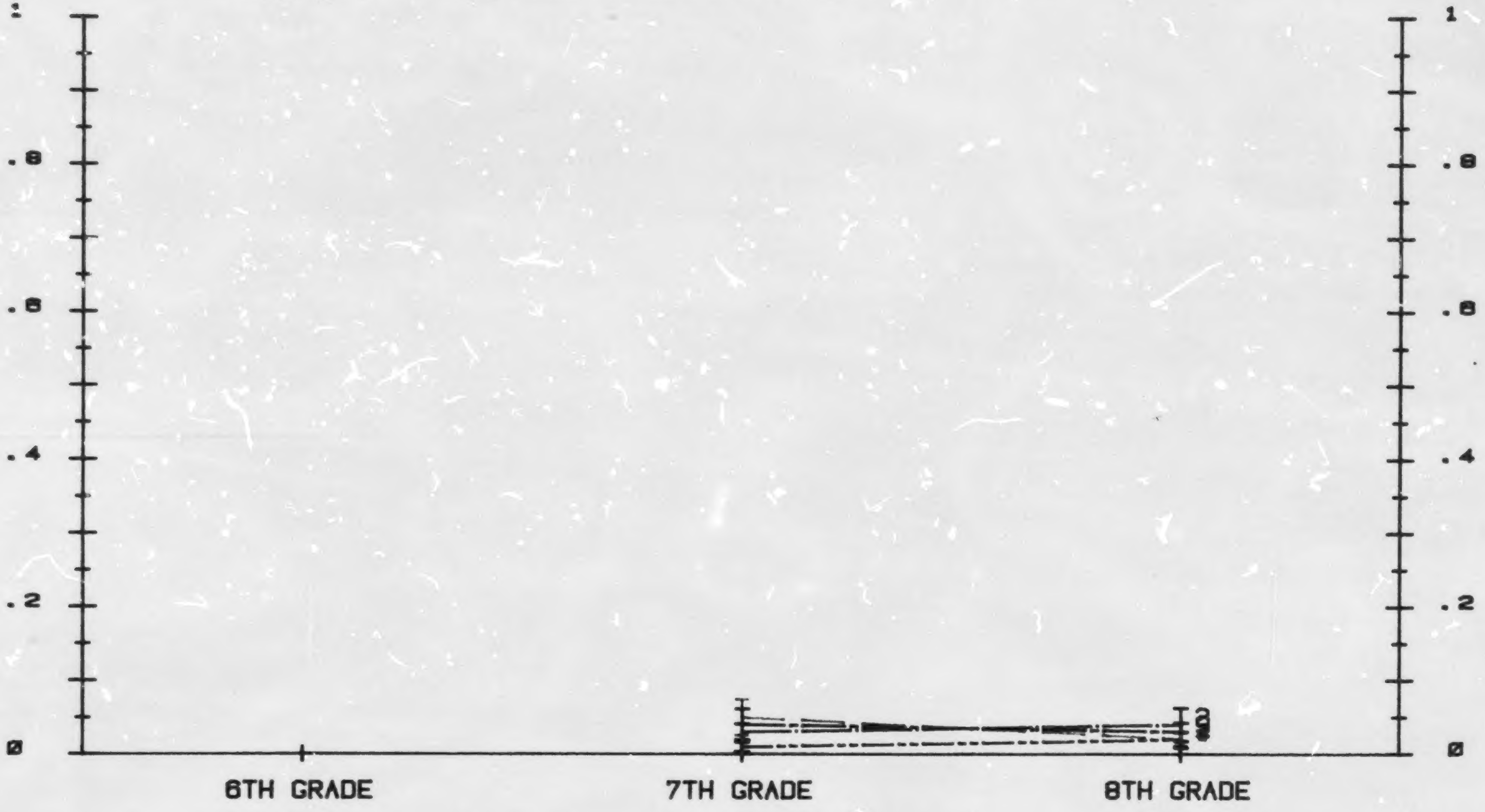
193



TEACHER INITIATED PROCEDURAL MF/D

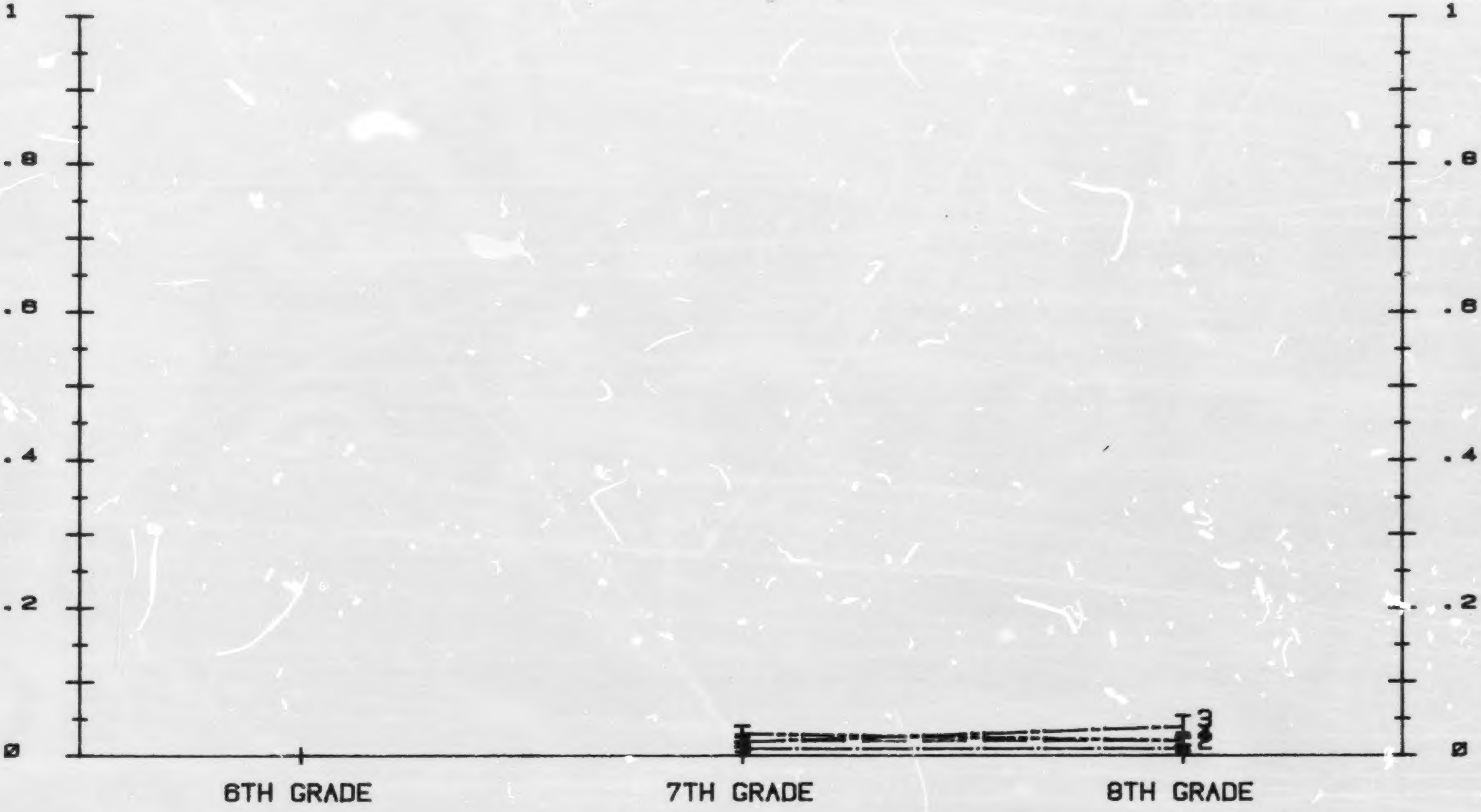
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.04	.12
2	—·—·—	FEMALE LOW CONF	*	.09	.13
3	———	MALE HIGH CONF	*	.08	.14
4	-·-·-·-	MALE LOW CONF	*	.05	.14

TEACHER INITIATED WORK - DON'T KNOW MF/D



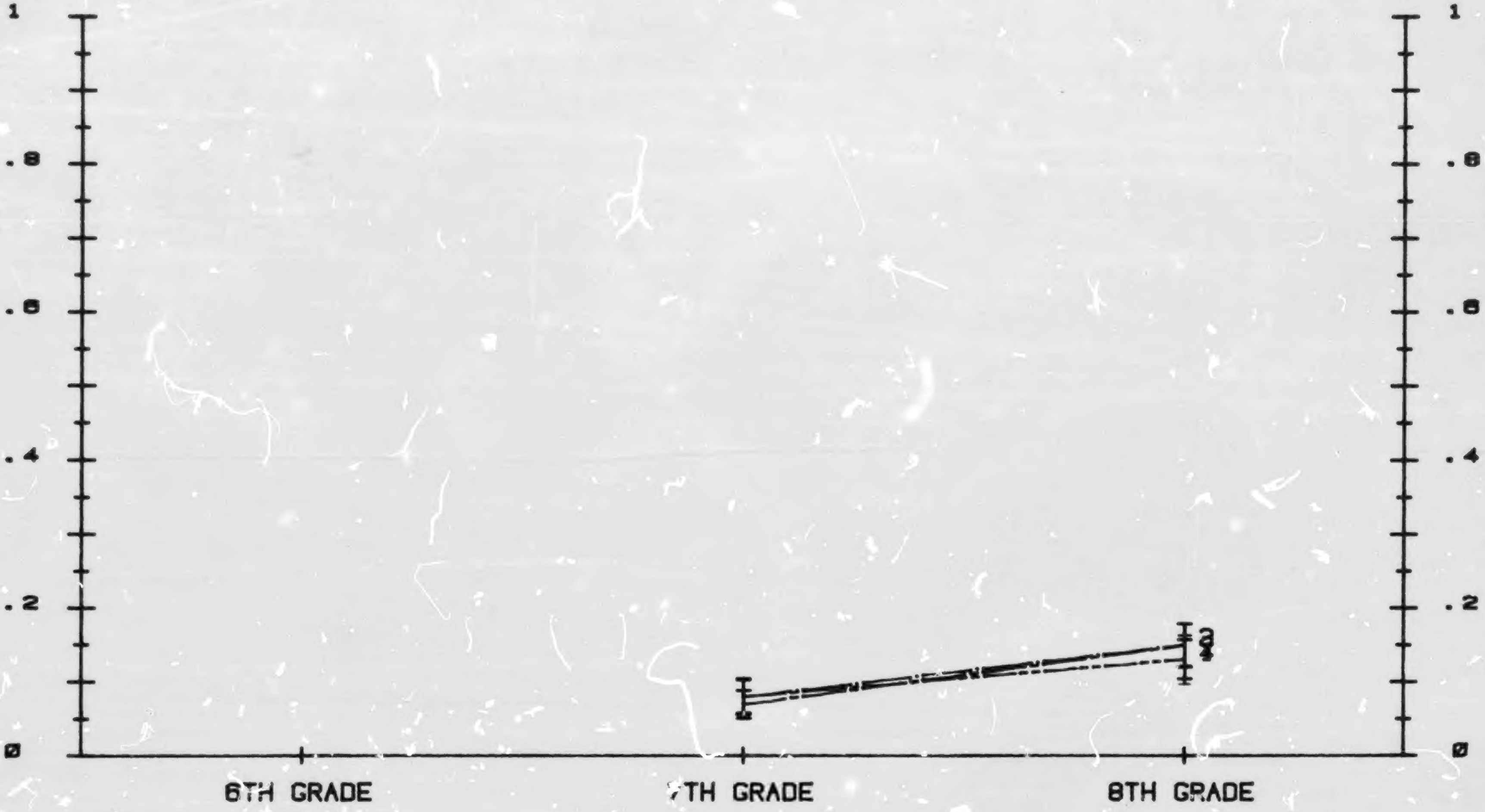
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.05	.02
2	——·——·—	FEMALE LOW CONF	*	.03	.04
3	——··——·—	MALE HIGH CONF	*	.04	.03
4	——···——·-	MALE LOW CONF	*	.01	.02

TEACHER INITIATED WORK - CRITICISM MF/D



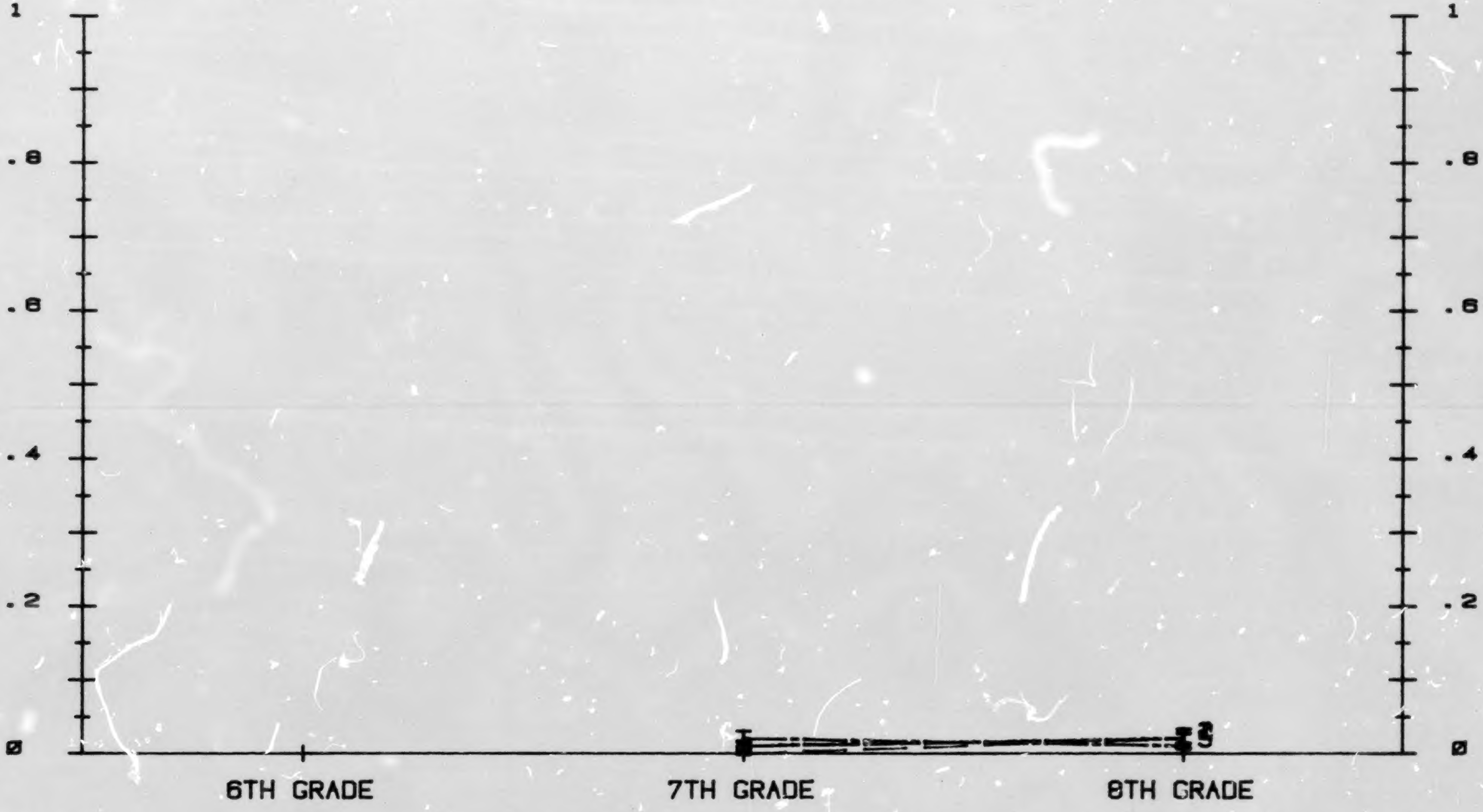
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.02	.02
2	—·—·—	FEMALE LOW CONF	*	.01	.01
3	-·-·-·-·-	MALE HIGH CONF	*	.02	.04
4	-·-·-·-·-·-	MALE LOW CONF	*	.03	.02

TEACHER INITIATED WORK - LOW LEVEL MF/D

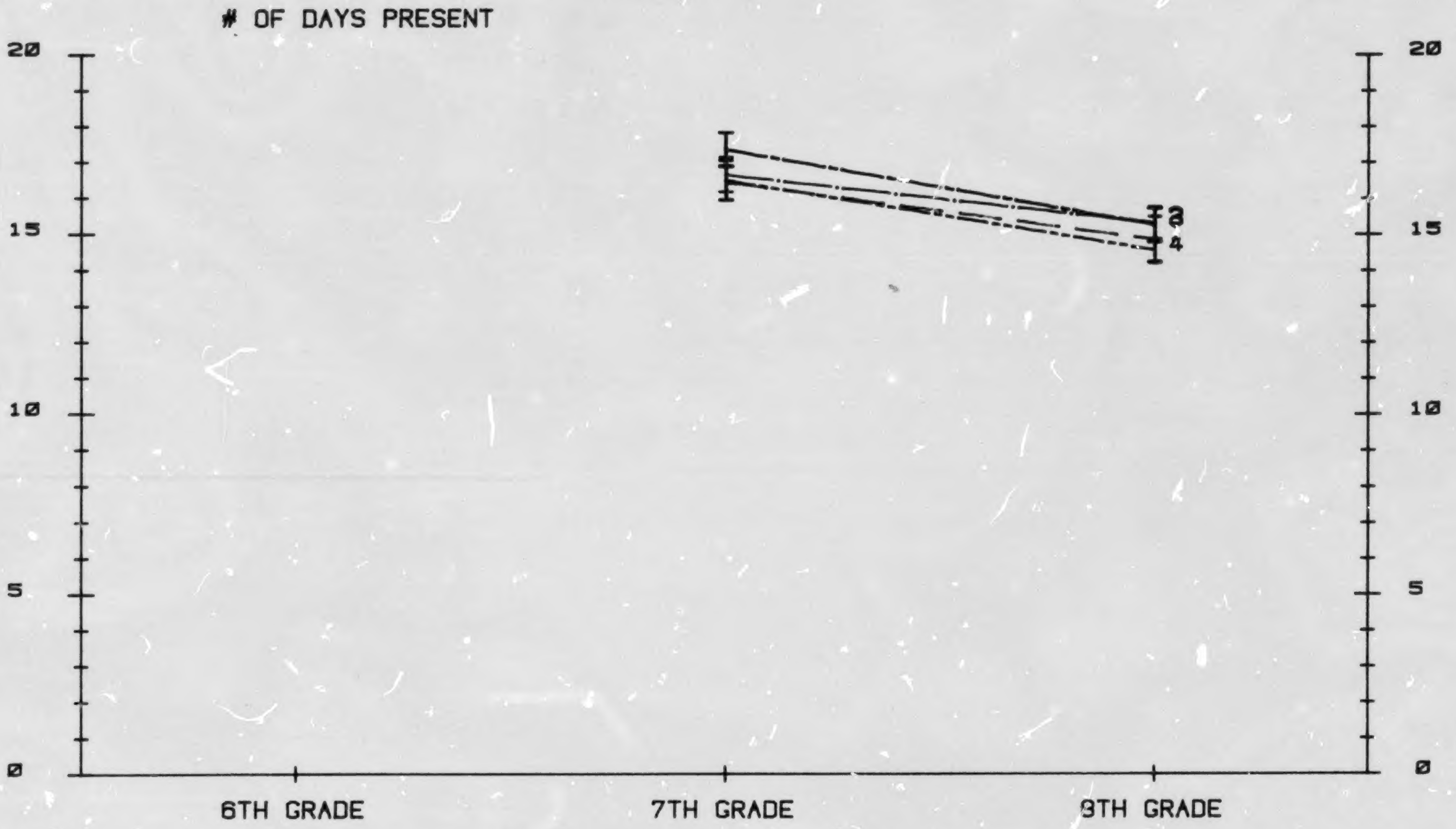


#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.08	.13
2	—·—·—	FEMALE LOW CONF	*	.08	.15
3	——————-—	MALE HIGH CONF	*	.07	.15
4	-·-·-·-·-	MALE LOW CONF	*	.08	.13

TEACHER INITIATED WORK - HIGH LEVEL MF/D

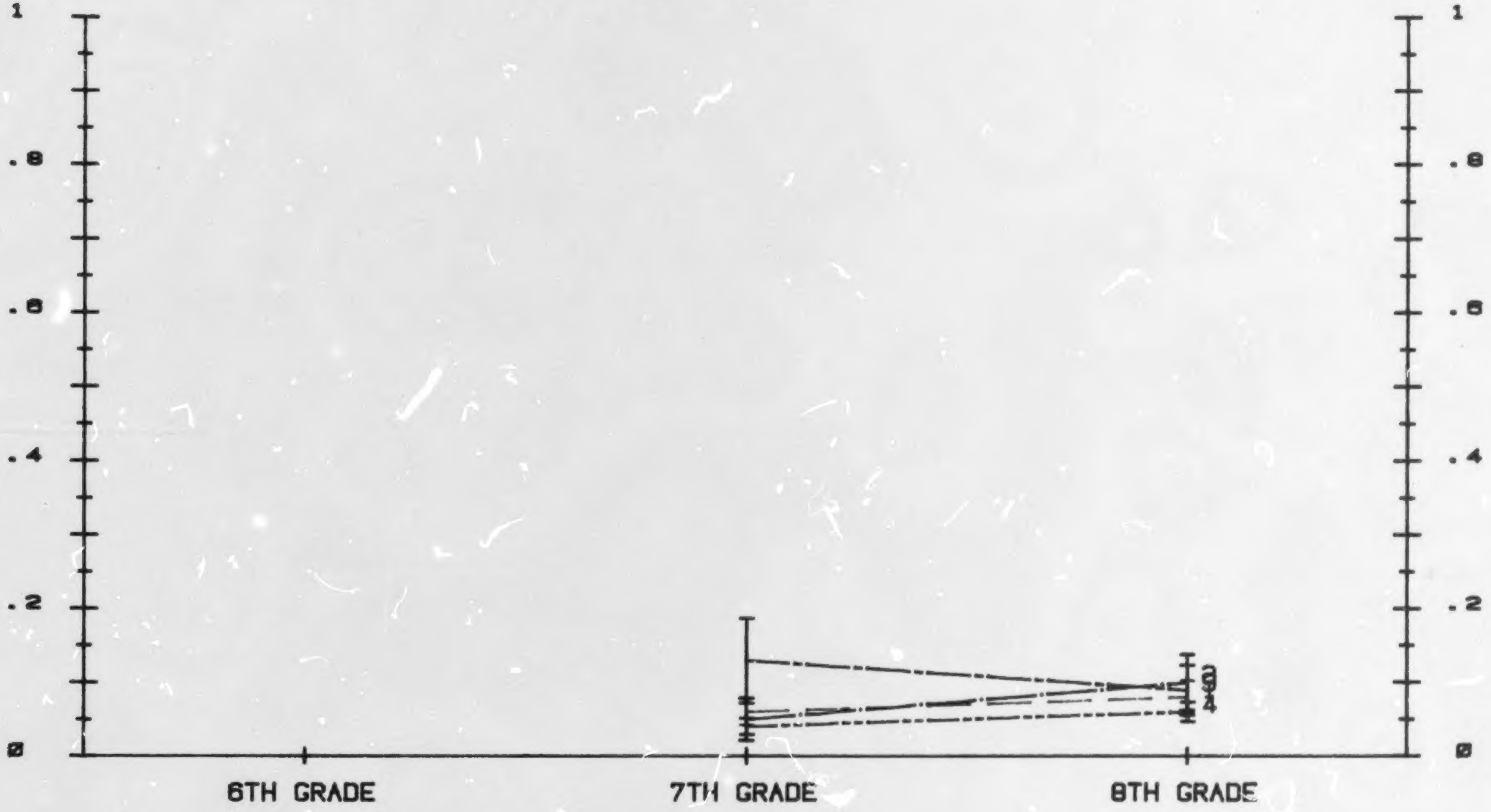


#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	—— —· ——	FEMALE HIGH CONF	*	0.00	.02
2	————·——	FEMALE LOW CONF	*	.01	.02
3	———·——	MALE HIGH CONF	*	.02	.01
4	···········	MALE LOW CONF	*	.01	.02



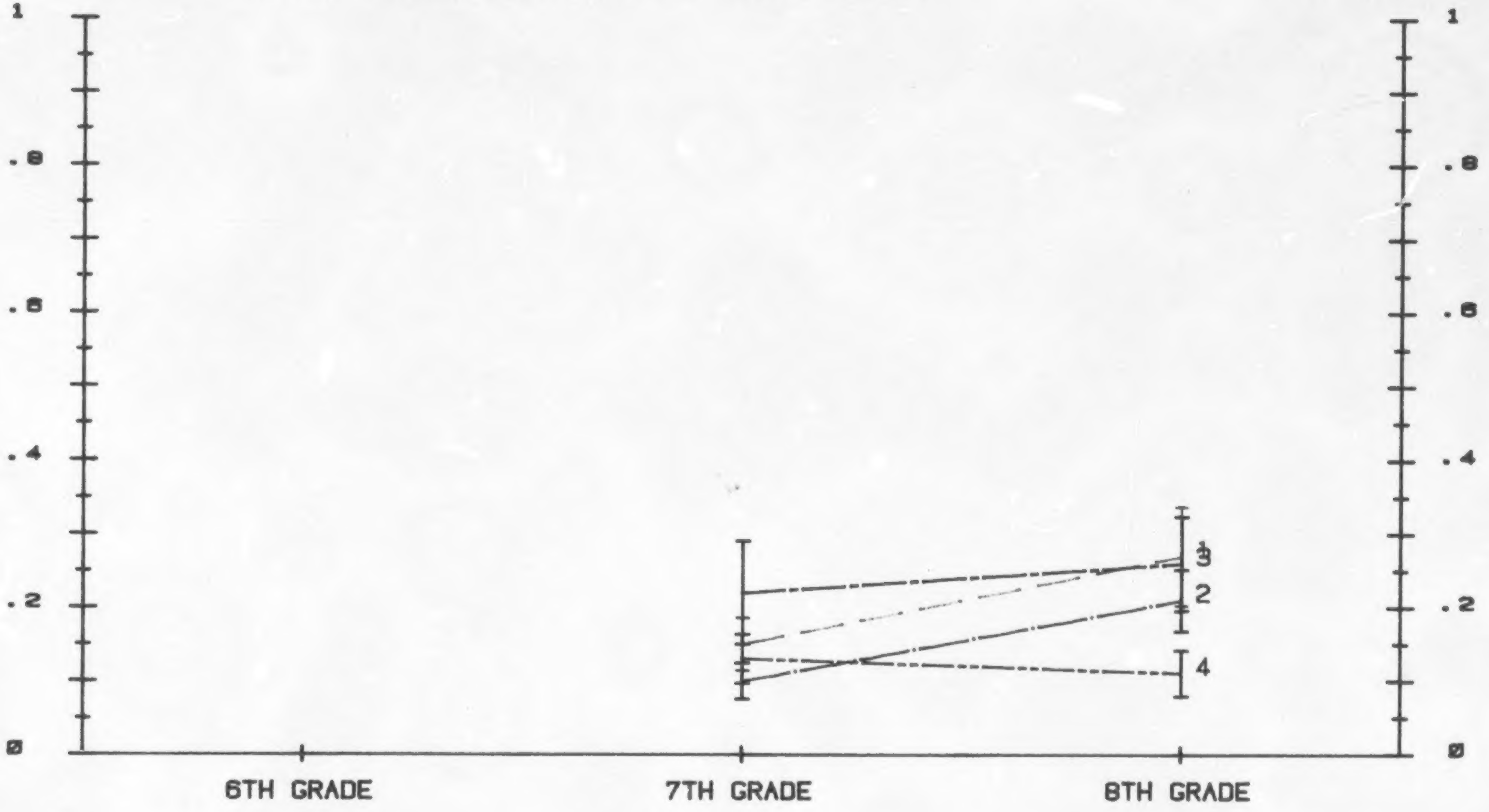
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — — —	FEMALE HIGH CONF	*	16.45	14.85
2	—·—·—	FEMALE LOW CONF	*	16.65	15.30
3	—··—··—	MALE HIGH CONF	*	17.37	15.27
4	—···—···—	MALE LOW CONF	*	16.50	14.55

STUDENT INITIATED WORK - DON'T KNOW MF/D



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.06	.08
2	——·——	FEMALE LOW CONF	*	.05	.10
3	—·—·—	MALE HIGH CONF	*	.13	.09
4	-·-·-·-	MALE LOW CONF	*	.04	.06

STUDENT INITIATED PROCEDURAL - NEUTRAL MF/D

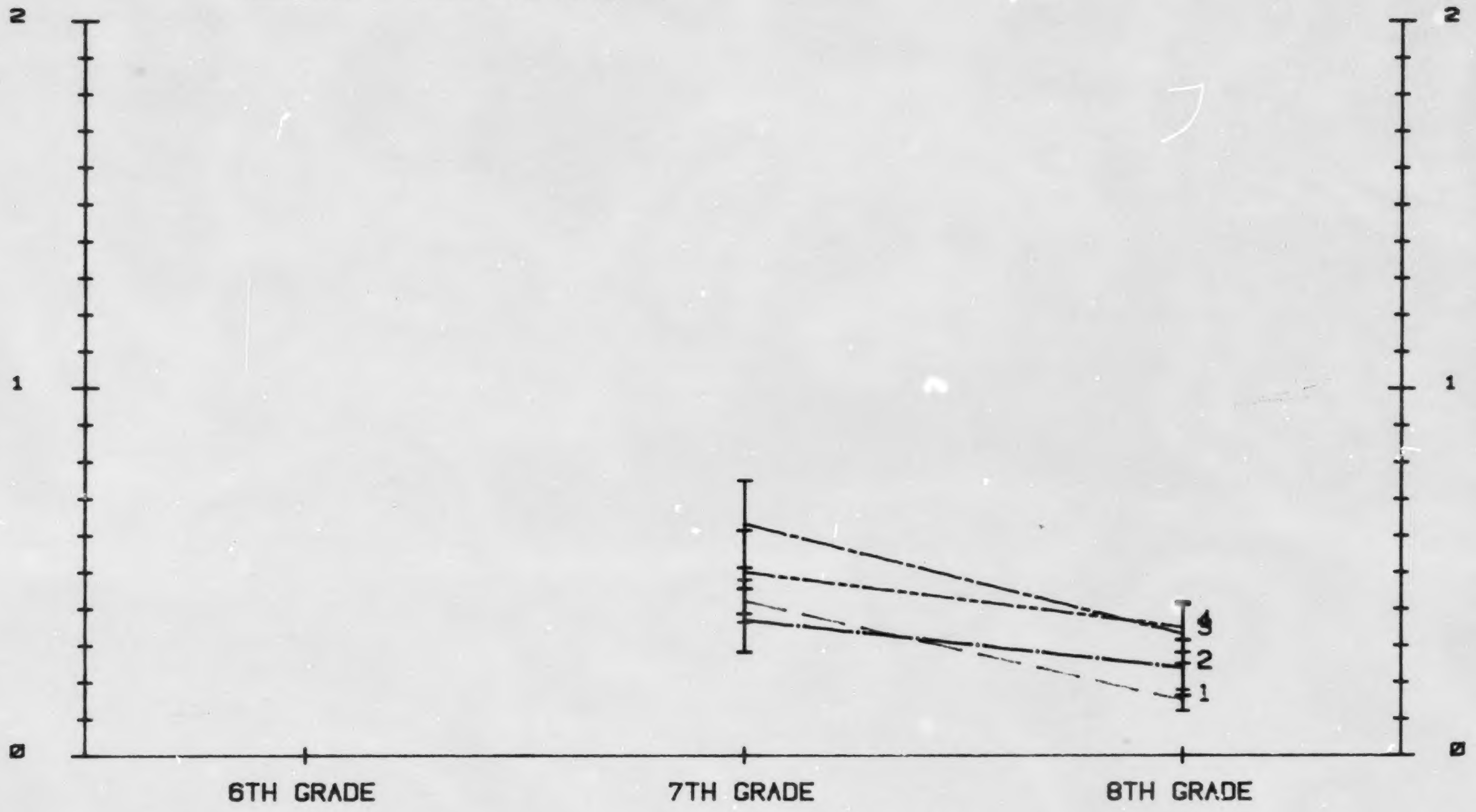


#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.15	.27
2	—·—·—	FEMALE LOW CONF	*	.10	.21
3	—··—··—	MALE HIGH CONF	*	.22	.28
4	-·-·-·-·-	MALE LOW CONF	*	.13	.11

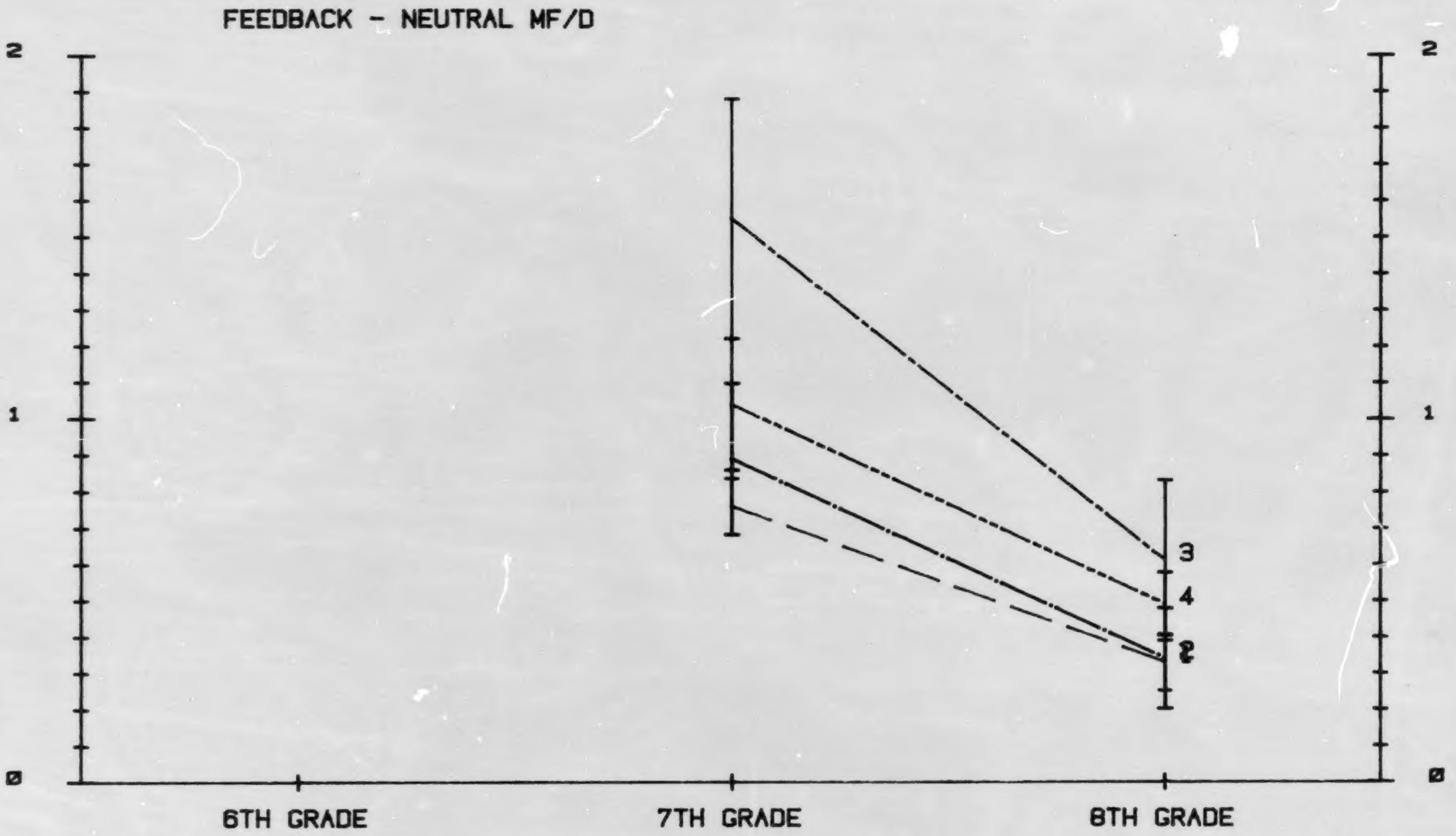
Appendix E

Teacher Feedback - Two Year Plots

FEEDBACK - POSITIVE MF/D

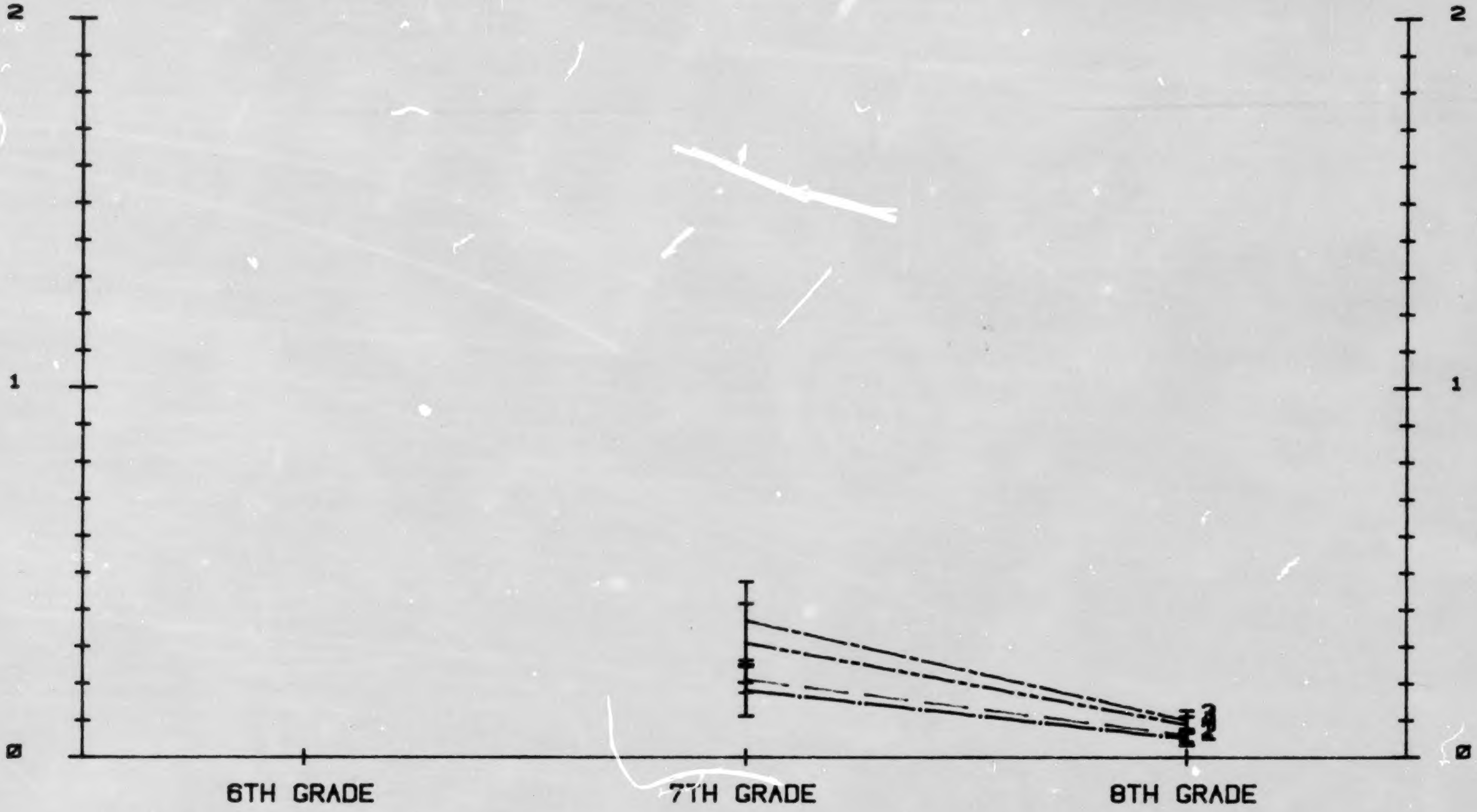


#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.42	.15
2	—·—	FEMALE LOW CONF	*	.37	.24
3	—·—·—	MALE HIGH CONF	*	.63	.33
4	-·-·-·-	MALE LOW CONF	*	.50	.35


FEEDBACK - NEUTRAL MF/D

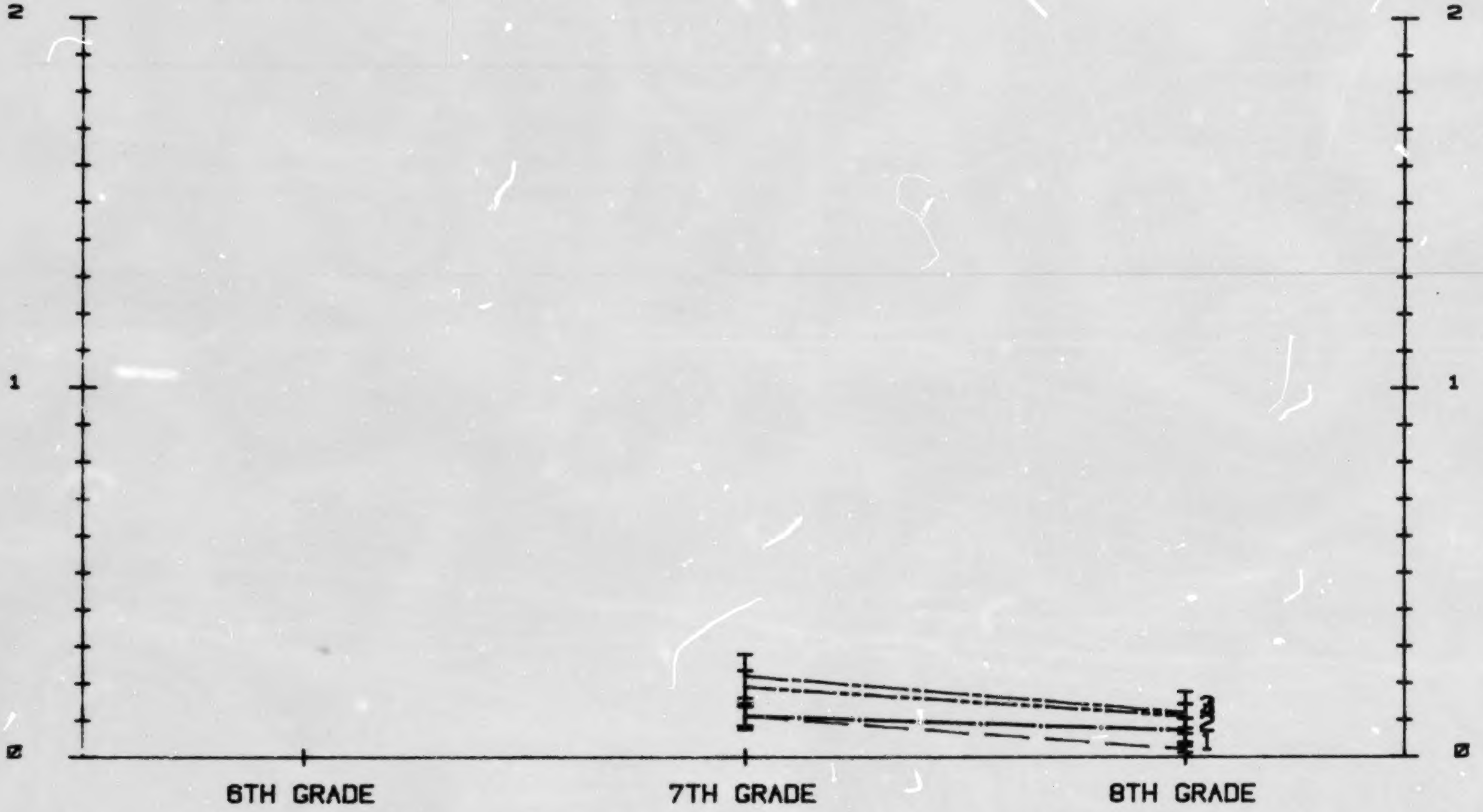
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.76	.33
2	——·——	FEMALE LOW CONF	*	.89	.34
3	—·—·—	MALE HIGH CONF	*	1.55	.61
4	-·-·-·-·-	MALE LOW CONF	*	1.04	.49

FEEDBACK - SUSTAINING MF/D



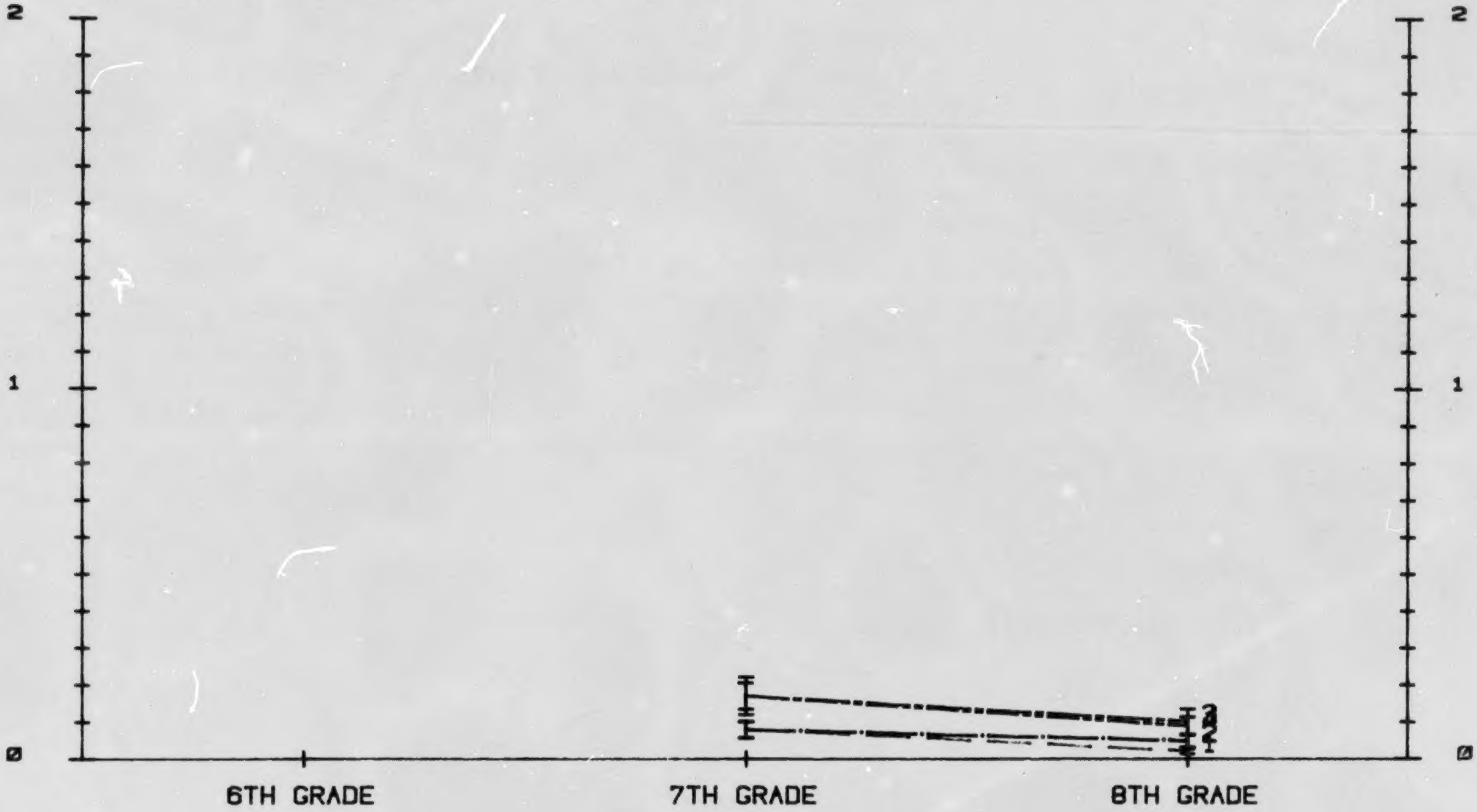
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — — —	FEMALE HIGH CONF	*	.21	.06
2	——·——·——	FEMALE LOW CONF	*	.18	.05
3	——·—·——	MALE HIGH CONF	*	.37	.10
4	——·-·-·—-	MALE LOW CONF	*	.31	.09

FEEDBACK - NEGATIVE MF/D



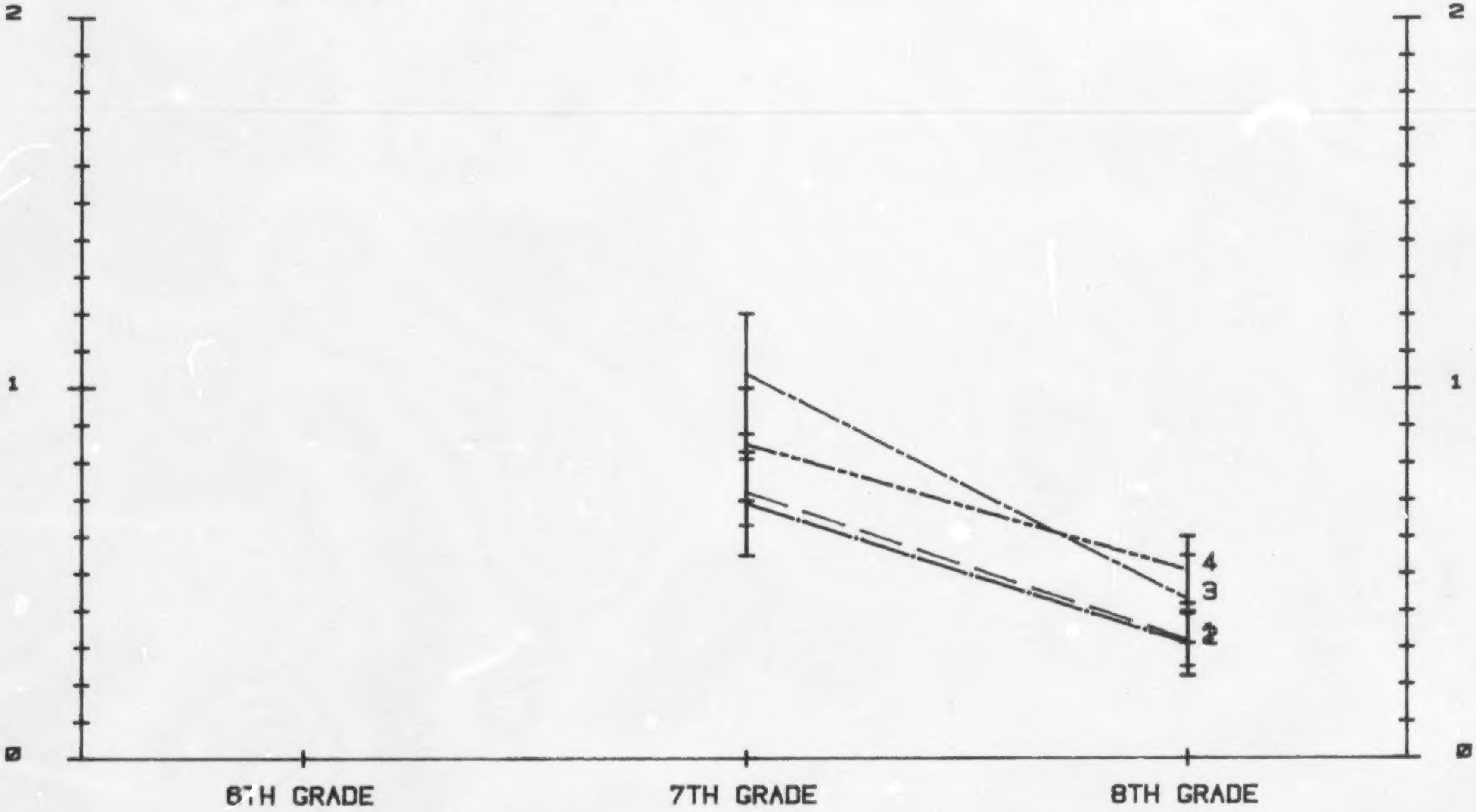
#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.11	.02
2	—·—·—	FEMALE LOW CONF	*	.11	.07
3	—·—·—	MALE HIGH CONF	*	.22	.12
4	—··—··—	MALE LOW CONF	*	.19	.11

STUDENT ANSWER - INCORRECT MF/D



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	—· —— —	FEMALE HIGH CONF	*	.08	.02
2	——·——·——	FEMALE LOW CONF	*	.08	.05
3	————·——	MALE HIGH CONF	*	.17	.10
4	——·-·-·-·-	MALE LOW CONF	*	.17	.09

STUDENT ANSWER - CORRECT MF/D



#		GROUP NAME	6TH GRADE	7TH GRADE	8TH GRADE
1	— — —	FEMALE HIGH CONF	*	.72	.32
2	——·——·——	FEMALE LOW CONF	*	.69	.31
3	—·—·—·—	MALE HIGH CONF	*	1.04	.43
4	-·-·-·-·-	MALE LOW CONF	*	.85	.51